Last making and last measurements

Tebbutt

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NORTHAMPTON
TECHNOLOGICAL HANDBOOKS

No. 2.

LAST MAKING
AND
LAST MEASUREMENTS.

WITH ILLUSTRATIONS.

LONDON:
PUBLISHED BY THE BURLINGTON PUBLISHING COMPANY, LIMITED,
72-76 TEMPLE CHAMBERS, BOUVERIE STREET, E.C.

NORTHAMPTON
TECHNOLOGICAL HANDBOOKS

EDITED BY

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Late Director of the Science, Art, and Technical Schools, Northampton.

No. 2.

LAST MAKING
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LAST MEASUREMENTS.

BY

ALBERT E. TEBBUTT.

WITH 36 ILLUSTRATIONS.

(SECOND EDITION—REVISED.

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PREFACE TO
THE SECOND EDITION.

Since the publication of the First Edition of this Handbook, in 1890, great changes have been made in the production of Lasts on a large scale, and it must be admitted that American machines and American methods are chiefly responsible for the revolution. The older hand methods, however, are not so obsolete that they can be entirely omitted from this pamphlet, and, even if they were entirely superseded, a short description of them would be historically interesting.

For much courteous assistance in the presentation of the newer methods of Last-making we are indebted to Mr. Sherman, of Brockton, U.S.A.; for the illustration of a modern Last-making Machine to Messrs. Gilman and Son, of Springfield, Vermont, U.S.A.; and to Messrs. Mobbs and Lewis, of Kettering, for the loan of a block to illustrate Easy-exit Lasts.

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LAST MAKING.

Objects of the Pamphlet.—The objects of this pamphlet are to give an account of the various materials, tools, and machines used in last making, and of the operations involved in the production of lasts by various methods, such as will be useful to students of technical classes in Boot and Shoe Manufacture; together with further details in respect to shapes and fittings such as may be of service to those only concerned with the business side of boot production.

Lasts.—A last may be defined as a mould or form of the human foot on which shoes are made. The word comes from the Anglo-Saxon "läst," or "liest"—a track, course, or footstep. Lasts should be models of the foot in outline and proportions, but feet vary so much, naturally and from acquired deformities, that, for the purposes of a wholesale trade, a compromise has to be made between the actual foot, an ideal foot, and what people think the foot ought to be like. Fashion is by no means a sleeping partner in this concern.

WOODS EMPLOYED IN LAST MAKING.

A typical wood for last making should possess the following characteristics: it should work easily, have no special tendency to split, and yet be fairly hard, so as not to be easily indented by blows; it should also be free from knots, finish up with a good surface, and not be afterwards influenced by changes of temperature and humidity in the atmosphere. No wood comes up to this ideal, but a careful selection of the wood and proper treatment will lead to a satisfactory approach to it.

Kinds of Wood.—The chief wood that has had an extended use in England is English beech; but hornbeam, maple, and sycamore have been utilised on occasion. All of these woods, and, indeed, some others, are quite suitable for last making when due care is exercised in their preparation; yet they were all very largely displaced, some years back, by charme, or what is more commonly known as French wood. Now the displacement of charme by the North American maple is taking place. This replacement of one wood by another is not so much due to differences in the the woods themselves as regards suitability, but rather to considerations of uniformity in quality and price.

In America, persimmon and other woods have been almost completely displaced by maple; but in England there lingers enough of the old hand process of last making with English woods and charme to justify a fairly complete description of the woods and the processes.

English beech (Fagus sylvatica)* is, undoubtedly, the best of all English woods for last making, though it varies to a considerable extent according to the rapidity of its growth, and, consequently, to the soil it is grown on. It has a remarkably smooth bark, and the thicker this is the better the wood, as a rule. Beech grown on a sandy soil has a thin, tough, and somewhat curly bark, and such wood last makers would, generally, reject. Good beech, in its natural condition, is of a colour inclining to brown, and combines the qualities of hardness and comparative freedom from knots; it is not so close in the grain as French wood or American maple, however.

The trunks of full-grown beech trees are usually sawn into planks, and only the trunks of small trees, or the boughs of larger ones, used for last making. Large trunks are, however, sometimes used, and in fig. 1 we give a drawing showing how such a trunk might be utilised. Suitable trunks or boughs are sawn into lengths of from 36 to 39

* It may interest Northamptonshire readers to know that beech-mast, or beech-nut, the fruit of the beech tree, was formerly known in England as buck; and the neighbouring county of Buckingham is so named from its fame as a beech-growing county.

inches, and then split into three or four (more if the trunk is large) triangular pieces by means of a wedge, or wedge-shaped knife and a sledge hammer, or a large wooden mallet called a betel. This is an operation easily performed, and with considerable rapidity by those used to it, as beech will readily split in a radial direction.

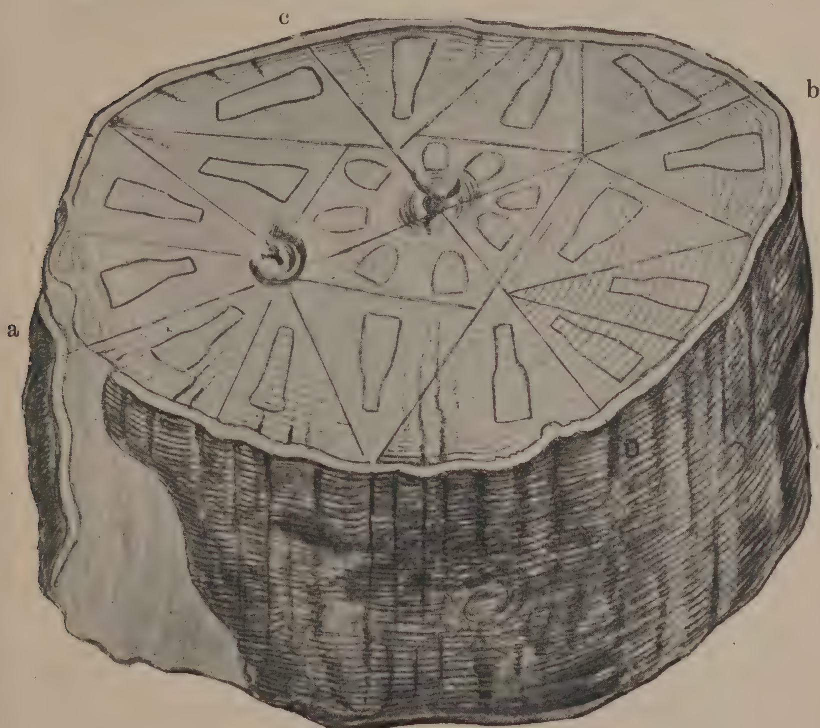


Fig. 1.

The wedge-shaped lengths, which will make three lasts, are called spokes (see fig. 2), and should be stacked in a dry, draughty place for two years, at least, before use, so that they may become thoroughly seasoned. They must not be exposed to direct sunshine or hot winds, or they will crack, in a radial direction, to an injurious extent; hence, a northern aspect for the drying shed is desirable. The stacks should be carefully isolated from the damp ground by some

non-porous material, or the wood will rapidly deteriorate, becoming quite soft and spongy; also it is better to separate the stacks from each other a little, in order to secure a better circulation of air.

However much beech may have been seasoned, it will still absorb moisture, and swell again if exposed to damp; therefore, it ought to be kept in a warm dry place just before use. To prevent after-shrinkage, the wood for lasts is sometimes steamed. This process more or less completely drives out the sap, and enables the wood to dry more quickly and more effectually; it also alters the appearance a little, and makes it of a slightly pink colour. It is supposed that after this treatment no after-shrinkage need be feared; but this is open to doubt. For another reason, however.

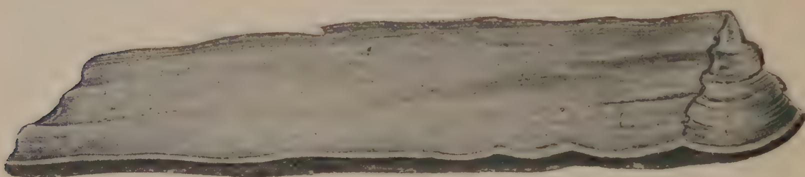


Fig. 2.

it is necessary to keep steamed wood, and lasts made from it, in a dry place, as, by the process it has undergone, it is rendered very susceptible to a kind of rot when it gets damp. Many last makers object to steamed wood; they consider that the process softens it somewhat, or, as they express it, "takes the nature out of it."

The method of treatment described above was the one adopted in Northampton and what may be described as the London district, but it was not universally followed. For instance, in some parts the wood was sawn into blocks of about the right length for a last at first, and, if the sawing was done by hand, this method had the advantage of being easier, i.e., the green wood was more easily sawn than the dry; also, other things being equal, the smaller blocks dry more effectually than the larger. Of course, small pieces are more trouble to stack than larger ones.

We have described rather fully the preparation of beech,

because it was the chief wood grown and prepared for last making in this country; but all woods required a somewhat similar treatment. A newer method is described under "North American Maple."

French Wood, or Charme (Carpinus betulus).—This is the same species of tree as the English hornbeam; but, having been grown in a different climate, it varies somewhat from the English wood. It is of a "kinder nature," as they term it—that is, it works more easily, probably because it has grown more quickly. French wood is imported in blocks, roughly shaped, as shown in fig. 3; these are known as chopped blocks. They can be procured of any length; but an undefined order of so many blocks might, probably, lead

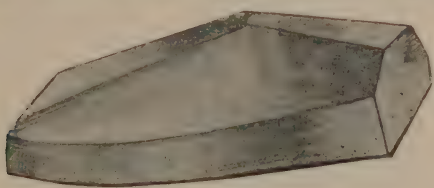


Fig. 3.
FRENCH BLOCK

to a larger proportion of small sizes being sent than would be desirable. The French wood is now very commonly imported in the form of turned blocks, i.e., the rough blocks are put through the last-maker's lathe before being sent; by this means much superfluous wood is left behind, and the carriage is proportionately reduced; also, of course, the hand last-maker is saved much of the heavier work. Charme is nearly white in colour, close in the grain, hard, and remarkably free from knots. It was regarded as the best wood available for last making; but whatever advantages it possessed over beech were, probably, due to greater care having been exercised in the selection, cutting, and drying of the wood by the French, so that more uniform results were obtained.

Hornbeam, or Yoke-Elm (Carpinus betulus).—The English tree of this name has a considerable resemblance to beech, except in its rounder and closer head; it has a smooth,

light-grey bark, but the trunk is often flattened and twisted as though composed of several stems united. As a tree it may grow to a height of from 40 to 70 feet, but mostly it is only grown for fences, etc. It thrives best on a stiff, clayey, and moist soil, and roots deeply; it does not do well on gravel or chalk. The wood is white and close-grained, of considerable tenacity, and little flexibility, and is so used for many purposes where these latter properties are of value, such as cogs, handles of tools, etc. It is supposed to owe its name of hornbeam to the fact that it is tough and hard to work, and of yoke-elm to its having been used for yokes for cattle.

English Maple.—The Common Maple (Acer campestre) is only occasionally used for last making in this country.

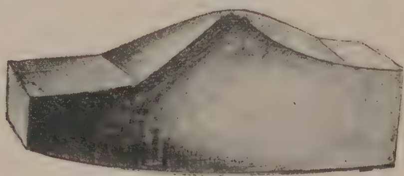


Fig. 4.
ENGLISH CHOPPED BLOCK.

The plant is common in our hedgerows, but is rarely seen as a tree. The wood is compact, has a fine, and often exceedingly pretty, grain, and takes a high polish.

Common Sycamore, or Great Maple (Acer pseudo-platanus).—This (which is usually called the plane tree in Scotland, although not a true plane) is a handsome tree of quick growth. The bark is smooth, the wood hard, and capable of taking a high polish; the young wood is white, and the old heart wood yellow or brownish. It is much valued by wheelwrights, cabinet makers, and other workers in wood. Like several of the other species of maple, sugar may be extracted from the sap.

North American Maple (Acer saccharinum).—This is the sugar maple, also called the rock, or bird's-eye maple; it is a fine tree, sometimes growing to the height of 100 feet. The tree is remarkable for the whiteness of its bark; the

wood also is white, but acquires a rosy tinge after exposure to light. The grain is fine and close, and the polished wood has a silky lustre. This wood, which to some extent takes the place of oak where the latter is scarce, exhibits two different arrangements of the fibres, one of undulations, and one of spots; the latter characteristic dictated the term "bird's-eye" for the wood. The sap may yield a considerable amount of sugar, but climate seems to exercise an important influence on this property.

The increasing use of American wood for last making in this country may be ascribed, perhaps, quite as much to its reliable qualities as to its cheapness, both being a result of system. The maple is grown especially for last-making purposes in some of the Western States of North America, the trees being cut down when from 12 to 15 years of age, so that only young trees of approximately the same diameter are utilised. They are felled in the autumn, and the main trunk is cut into lengths of 6 to 10 feet, which are left with the bark on. After about three months these blocks are cut into shorter lengths, and split into three parts or blocks, and herein lies one of the special advantages of the system,—the trunks are all just about the same size, and that size admits of every last being a bark-bottomed one. The blocks are rough turned, by machines which manipulate as many as 12,000 pairs per day, and are then stacked in open, but rain-proof, sheds, and are air-dried for three years. The immediate preparation for turning the blocks into lasts, after importation into this country, consists of three months' stove drying, in which the time and the temperature are progressively increased; for instance, half an hour at a moderate temperature suffices for the first day, and ultimately they are in the oven for 24 hours of the day at a temperature of 90 degrees Centigrade. Even with this care about 20 per cent. of the blocks are spoiled by splitting, and without such care the loss might reach 70 to 80 per cent. After this treatment the lasts will not shrink; but they may swell if not kept in a dry place. In any case, since the lasts are all bark bottoms, any slight variations in size are of less consequence.

PERSIMMON (Diospyrus Virginiana).—Persimmon is a tree which grows chiefly in the Southern States of North America, where it attains the height of 60 feet or more. It bears a fruit about the size of a small plum, which is also called persimmon, and is luscious and nutritious when ripe. The wood of this tree seemed likely at one time to be a successful competitor with maple for last production, as it is a harder and heavier wood; but at present it is seldom used, except in the making of models for turning, for which purpose its hardness fits it. A finished last in persimmon is not very unlike a beech one in colour and other qualities.

The making of shoes does not come within the province of this pamphlet; but we may mention here that the peasantry of France and neighbouring countries prefer beech, or alder, for making their "sabots" or wooden shoes, under the idea that these do not so readily absorb water as most other woods that are available.

ALDER (Alnus glutinosa) is also the wood chiefly used in making the clog soles so often worn in some of our northern towns. It would seem to be a very suitable material for the purpose, as it has always been considered one of the best woods for withstanding damp, and has been much used for underground purposes, and even for water-pipes, after being hollowed out. Besides these, it has many other uses; its wood makes excellent charcoal for gunpowder, its bark may be used for tanning, and the young shoots for dyeing various colours, when mixed with other ingredients. Alder grows best on a moist soil.

WILLOW (Salix) is used for making "klompen" or wooden shoes in Holland. The willow trees are grown for the purpose, and only the trunk is used. The wood is cut about the right size, roughly shaped, and afterwards finished off with sandpaper and pumice-stone. Newly-made shoes are thoroughly dried—almost baked—in front of a fire before use.

STRUCTURE OF WOOD.

We shall presently have to speak about some characteristics of lasts that depend upon the structure of

wood in general; hence, a short description of the structure seems to come appropriately here. All the trees we have enumerated, and, indeed, all the wood-producing trees of Britain, belong to the class of flowering plants called Dicotyledons. These plants or trees grow from the outside,* that is, the new wood is produced between the bark and the old wood; hence, so long as the tree grows it will continue to increase in girth. This accounts for the rough and shattered appearance of the bark in most trees, for it is evident that, unless the bark can stretch considerably, it must crack, in order to accommodate the increasing thickness of wood within. The smooth appearance of the bark of beech, and some few other trees, arises from the fact that in these cases the bark itself retains, during healthy growth, sufficient vitality to permit of a dilatation equal to the increased girth of the tree.† It follows from these considerations that the newest, or sap, wood, that nearest the bark, will be less dense than the heart wood in the interior, and so will shrink most during drying, and subsequently be most affected by changes of temperature and humidity in the atmosphere.

Again, in cold and temperate climates the trees grow only during a portion of the year, and the growth is most rapid in the spring and early summer; the late summer and autumn growth being slower produces a denser and closer-grained wood. Consequently, a distinguishable ring is formed in the trunk or stem each year; by the number of these rings in the trunk, indeed, the age of the tree may be calculated, one year for each ring.

A cross section, then, through the perfect stem of an ordinary tree would show, in or near the centre, a small, soft, and useless core, which is the original pith; outside this, and forming the great mass of the wood, the heart-wood

* On this account they are called exogens.

† We may mention incidentally that in trees of the same species the character of the wood may generally be predicted by the character of the bark. A quick growing tree will have a rougher and more shattered bark than one that grows more slowly, and the wood of the former will be less dense, and work more easily than that of the latter.

and sap-wood, both ringed, and not, as a rule, distinctly separable from each other; then the bark. As the tree gets older the rings have a greater circumference, and are somewhat proportionately closer together; so that in a very old tree it is a matter of difficulty to count them. More than a thousand of these rings have been counted in some old trees.

As was hinted before, the core is useless, and so is the wood immediately surrounding it, to a last maker; it is very splintery, and, in a properly-seasoned trunk, generally much cracked (see fig. 1, page 7). The core and this portion, together called the heart, is rejected. Although for economic purposes it is not generally possible to draw a hard and fast line between heart-wood and sap-wood, still the darker colour of the heart-wood is sometimes as distinctly traceable as one of the annual rings, and, since the change of colour is, probably, due to chemical or fermentative changes in the wood itself, it naturally affects its quality. Many ornamental woods derive their value from the changes in colour above referred to.

One other point it is necessary to speak of. Besides the annual rings, the section of a tree will usually show a number of narrow rays stretching from the pith to the bark; these are called medullary rays. In most trees these rays are very narrow; but in the oak they are very noticeable, and form what is called the silver grain when the wood is cut lengthwise in the plane of them.

Shrinkage of Wood.—Besides the structures which belong to the tree in its natural condition, a trunk or stem that has been severed from the tree and exposed to a dry atmosphere for some time will show a number of cracks extending from the bark towards the centre. These cracks tell us not only that the wood is shrinking, but also the direction and extent of the shrinkage. It will be seen, for instance, that the cracks are widest and most numerous towards the bark, and that they run towards the centre of the trunk, thus proving that the shrinking takes place circularly, and parallel with the bark, i.e., approximately at right angles to the medullary rays, or, to put it in another way, as nearly as may be at right angles to the cracks (see fig. 1, page 7).

The extent of the cracks, naturally, measures the extent of the shrinkage. The shrinkage in other directions is so small as to be negligible.

We will now attempt to apply the information given above to our special subject.

Bark Bottoms and Bark Sides.—When lasts are made from large trunks of trees, it is not economical to cut the wood so that the soles, for instance, all lie in the same direction with respect to the bark (see fig. 1, page 7). Again, unless very great care is taken—much greater care, indeed, than used to be taken—lasts cannot be relied upon to keep their shapes and always give identically the same measurements; they may swell in a damp atmosphere, or shrink in a dry one, shrinkage being most commonly observed as the wood gets more thoroughly dry. Since the sap-wood—that nearest the bark—shrinks most, it is a matter of some importance to have each last of a pair made the same—that is, with both soles from the sap-wood (bark bottoms), or both sides from the sap-wood (bark sides). The former will shrink in width, and the latter in height. As an example of the amount of shrinkage to be anticipated where ordinary care is exercised we give the following:—A 7's last with bark bottoms was made from wood which had been stacked upwards of two years, but was not fully dry; it measured when first made:

Length, $10\frac{2}{3}$in. Joint, 9in. Instep, $9\frac{1}{2}$in.

After remaining about two months in a dry room it measured:

Length, $10\frac{2}{3}$in. Joint, $8\frac{3}{4}$in. Instep, $9\frac{1}{4}$in.

A last made of wet (so-called green) wood would have shrunk, probably, twice as much as this.

To know whether both lasts are alike in respect to the direction in which the wood has been cut, and also to know in what dimensions the last is likely to have changed, it is necessary to be able to distinguish bark bottoms from bark sides.

How to Distinguish Bark Bottoms from Bark Sides.—Bearing in mind what was said about the structure of wood, it becomes an easy matter to distinguish a last that has bark

bottoms from one that has bark sides. In a bark-bottomed last—that is, one in which the sole was cut from the wood nearest the bark—the curves of the sole will expose parts of various rings, which will appear as transverse markings across it. These rings will be nearest together where the curvature is greatest, and a considerable distance apart where the sole is nearly flat. (see fig. 5). In a bark-sided

BARK BOTTOM

Fig. 5.

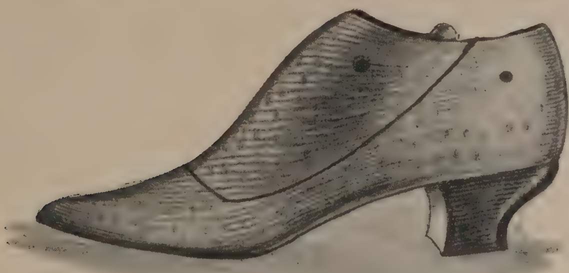
BARK SIDE

Fig. 6.

last the rings or lines of growth in the wood will be shown longitudinally, i.e., the sole extending from the bark towards the centre, in width, will necessarily show the rings in nearly straight lines, and nearly or quite as close together as they would be in a cross section of the wood (see fig. 6).

It is important not to confuse the medullary rays with the annual rings; the former are sometimes more prominent than the latter, and necessarily at right angles to them. The medullary rays are shown on all the figures

from 5 to 8 inclusive, and it will be noticed that they are not always thin lines like what might have been expected from the description of them previously given; this is because of the various curves of the last, which in places expose



BARK BOTTOM.

Fig. 7.

the sides of the thin plates of cellular tissue which constitute the medullary rays.

Figures 7 and 8 give side views of a bark-bottomed and bark-sided last respectively.

Cutting-up of Wood.—Bark bottoms, then, shrink in

BARK SIDE

Fig. 8.

width, and bark sides in height; which is the least objectionable? It is usually considered that bark sides are preferable to bark bottoms, because any decrease in height can be easily remedied by fittings, whereas this is not so easily done when the decrease is in width of sole. In the case of

models for iron lasts, too, any shrinkage in height can be remedied by the block, where this latter is of wood. However desirable it may be to have bark sides, a large proportion of bark bottoms is almost a necessity, excepting when the trees are grown and cut especially for lasts. The decision as to which a pair of lasts shall belong is influenced by a number of considerations, such as size of wood, character of spoke, flaws or cracks, etc.

The size of the wood acts in this manner. The triangular en dof a beech spoke for last makers (see fig. 2, page 8) would have, on the average, a base of from 5 to 6 inches, and a height of from 5 to 6 inches. This would cut a bark-bottomed last; but a trunk or stem less than 10 inches in diameter, i.e., less than 5 inches in radius, would most likely require the lasts to be bark-sided, in order to get the necessary height for the instep. It is always best, if possible, to make bark sides with small branches, because the wood near the centre splits a good deal, and, therefore, it is undesirable to have the instep running into it. One other point in connection with the cutting up of small wood deserves notice; if the side of a spoke had a very flat and regular surface, it might allow of a greater height of instep to a bark-sided last than to a bark-bottomed one, because, of course, the wood forming the curve towards the bark would all have to be taken off, and this curve is greater the smaller the trunk. Blocks that are to be turned by the last-making machine must be cut a little larger than those for hand work. (See section on machines.)

Large trunks require a different treatment to small ones, and generally there will be more waste, because, after taking out the useless wood at the centre (the heart), and dividing up the remainder as well as possible from the circumference, there will generally remain, towards the centre, pieces unsuited for either lasts or blocks. In fig. 1, page 7, we give a drawing of a large block marked up for splitting. It would first of all be split into four parts along the lines a b and c d, and then be divided up about as shown by the other lines. The same figure shows what kind of last each piece would, perhaps, most conveniently furnish; for in-

stance, this block cut up as shown would yield of lasts nine bark bottoms, three bark sides, and three neither bark sides nor bark bottoms, called bastards or quarter-pieces; of top-pieces or blocks 16 or more.

Treatment of Lasts.—Whatever care may have been exercised in seasoning the wood from which lasts are made, they are certain to be more or less affected by great changes of temperature or humidity; therefore, they should be stored in a dry room, preferably one that can be warmed in very cold weather. It is a bad practice to hang lasts from the ceiling of a workroom, because at a time of the year when the nights may be very cold the burning of gas during the latter part of the working day will make the atmosphere near the ceiling both very hot and very moist.

TOOLS EMPLOYED IN HAND LAST MAKING.

Excepting where a last-maker's lathe is employed, the tools used in the construction of hand-made lasts are comparatively simple, and not very numerous. A description of those used in the ordinary way is given below.

Wedge and Sledge Hammer.—These are used for splitting up trunks, together with a smaller hammer for sundry purposes. In place of the wedge a large wedge-shaped knife with handle is sometimes used, but the blows on this jar the hand considerably; also, in place of the sledge-hammer, a wooden mallet, called a "betel," is commonly used.

Bench (see fig. 9).—This is generally made about 1 foot 9 inches to 2 feet in height, and, preferably, has a beech top 3 inches in thickness, with stout posts at the corners, and cross pieces mortised at the bottom, so that the bench may be nailed or screwed down firmly. Firmness of the bench is an absolute necessity for satisfactory work. The size of the bench is rather a matter of individual opinion; but 4 feet long by 2½ feet wide would, we believe, be satisfactory to most last makers. Sometimes, at the back of the bench, a narrow shelf is fixed, more nearly on a level with the eye; by placing a pair of lasts on this together, their exact simi-

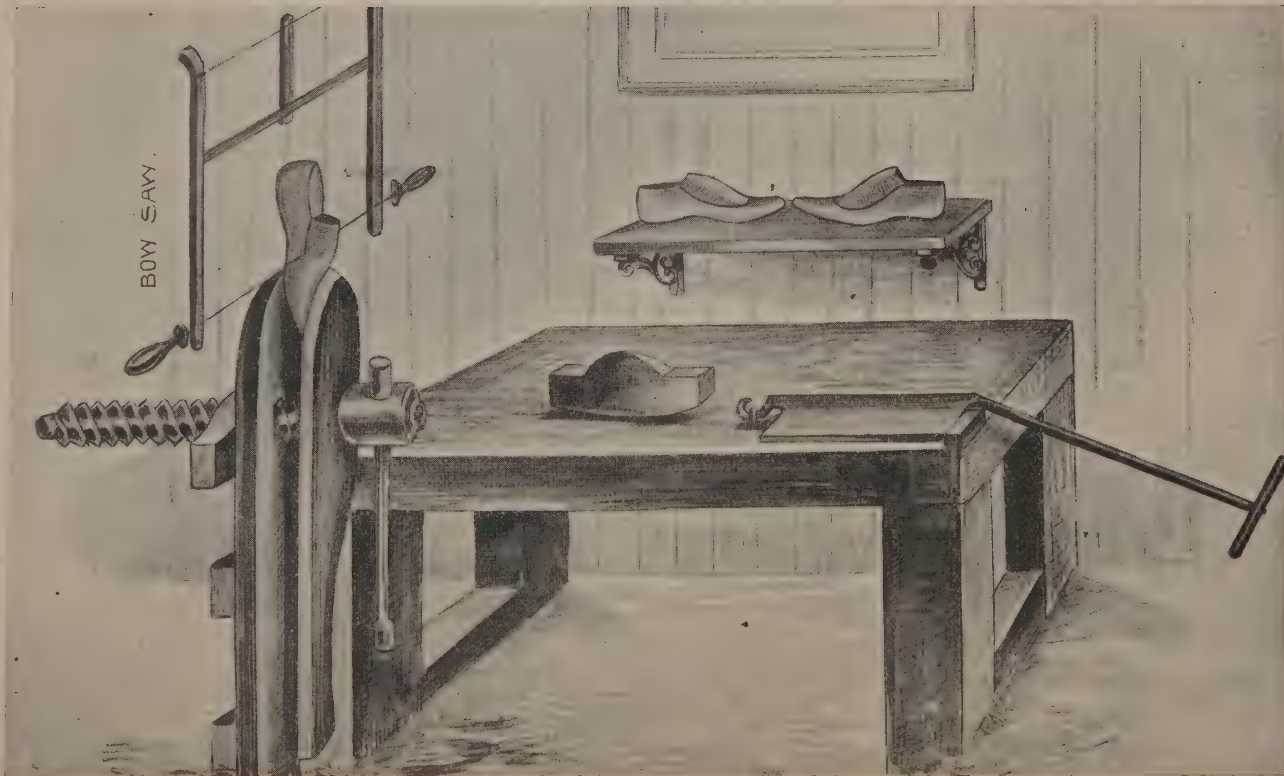


Fig. 9.—LAST MAKER'S BENCH.

larity or otherwise, as regards pitch and spring, may be readily seen (see fig. 9).

The Bench-Knife (see fig. 9) consists of a long blade of steel, about 15 inches in length and 3 inches wide, when new; it is hollow-ground on the upper side, somewhat like a razor, but convex on the under side, so that from back to front it is gouge-shaped. It is ground on the bevel or under side only. The knife is affixed to the bench by a hook-pin at one end, which hook-pin passes through a staple in the bench, the pin being retained in place by a packing of leather bits under it. To the other end of the knife is attached, in an inclined direction, an iron stem, some 20 inches or more in length, and this is terminated by a wooden handle, at right angles to the bar just mentioned, to be grasped by the workman. The packing of leather under the hook-pin not only keeps the knife from coming out of the staple, but also prevents it from slipping about; so that the structure and mode of fixing of the knife give the advantage of a powerful lever, and allow of both an up and down motion, together with a considerable amount of lateral motion.

A Wooden Vice (see fig. 9) is attached to the bench, sometimes as much as 18 inches in front of it, or it may be at the side, according to the fancy of the workman or the space at his command. It should be so arranged that it is an easy matter for the workman to move from knife to vice and vice to knife; therefore, a vice in front of the bench would seem the better arrangement. The vice is rather massive, is carefully rounded off where it grips the last, so that it shall not leave disfiguring marks. It rises some 15 inches above the bench, and firmness is quite as much a necessity with this as with the bench.

A Coachmaker's Axe (see fig. 10) is used to chop out the blocks in the rough to somewhat the shape shown in fig. 4, page 10, so that the knife may be relieved of some of the heavier and coarser work. The axe is ground flat on one side, and bevelled on the other, in order that the chips may fly off more readily.

Rasps are used to take out the coarser marks left by the

knife, and bring the lasts more nearly to the required measurements. English rasps are circularly cut, and French

Fig. 10.

COACHMAKER'S AXE.

diagonally, though both kinds may be procured of English manufacture. Some last makers prefer French rasps be-

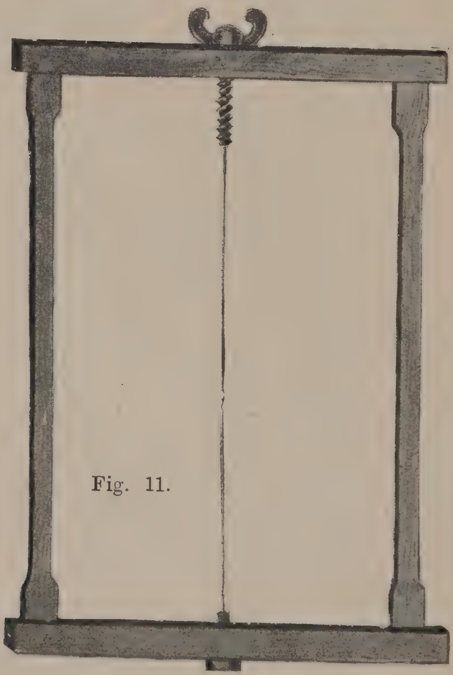


Fig. 11.

AN UP-AND-DOWN SAW.

cause they are better tempered and cut, whereas others prefer only the circularly-cut rasp; they say that the dia-

gonally-cut rasp may, by going over the same place more than once, leave ridges and furrows, the latter deeper than desirable, whereas circularly-cut rasps cannot. The rasps here referred to are made especially for last makers, but sometimes a cabinet-maker's half-round file is used after the rasp.

An Up-and-Down Saw or Bow Saw is used to cut out the block. The up and down saw (see fig. 11) is heavier than the bow saw; so, being firmer, it leads to more accurate work, and is the one most used. The bow saw, however (see fig. 9, page 20), is perfectly satisfactory in the hands of a good workman.

A Hand Saw and Tenon Saw are used, the former for sawing spokes into the required length, and the latter for sawing down the front of the block. Where available a

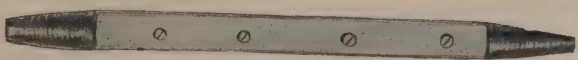


Fig. 12.
COARSE SCRAPER.

circular saw may be used with advantage in place of the axe in roughly shaping the last, and a band saw for sawing the block.

Other common tools are useful for various purposes, such as a carpenter's brace and bits for drilling hole in the block, etc.; a chisel for cutting groove in the block, in the case of models; a plane for planing the bar which is tacked on in front of the last for the block to fit on.

A Coarse Scraper.—This consists of a thin piece of steel, about $1\frac{1}{4}$ inches wide and 12 inches long, screwed on to a flattish, triangular-shaped piece of wood rather longer than itself, the projecting ends answering for handles (see fig. 12). This scraper is really a buff-knife, with the exception that each side has only one edge on it, instead of two. The so-called wire edge is produced thus:—A fine edge is first of all put on to the knife with a file, or by grinding, and this edge is then bent over by running a currier's steel along one side, gradually increasing the pressure as the edge gets

turned, and there is less chance of injuring the edge itself. The scraper is used to take out the marks left by the rasp. A currier's steel is a thin, round piece of steel, something like an awl, especially hardened for its particular use.

The Fine Scraper is a very thin piece of steel about 1 inch wide, not mounted on wood. This is sharpened in the same manner as the coarse scraper, but the edge is turned both ways, by use of the currier's steel, so that there are four edges instead of two, thus making it into a true buff-knife. Not being mounted, the fine scraper can be used to greater advantage in the curves of the last.

Another fine scraper is used by some workmen, more particularly for the deeper curves of the last, where it is difficult to work with a straight one. It consists of a semi-

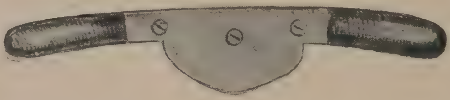


Fig. 13.
FINE SCRAPER.

circular piece of steel rather stiffer than either of the other scrapers, with one edge only; it is screwed on to a piece of wood which acts as a handle (see fig. 13). This is very useful when making shoe lasts. A piece of dog-fish skin, fixed on to a small block of wood, was at one time commonly used in place of the fine scraper; it is coarser than most sandpaper, and lasts much longer. The practice seems to be quite obsolete.

Glass or Sand Paper is used to put the finish on the last, when it is not required to be polished. A deer bone was at one time considered a necessary piece of kit, and used for putting a temporary polish on lasts, but is seldom used now.

Chalk, although not, strictly speaking, a tool, is very necessary, in order to prevent lasts slipping in the vice or on the bench. The neglect of its use may lead to rather serious mishaps. The utility of chalk for the purposes named may be well illustrated by making a wide chalk mark

on a smooth piece of board, and then sliding a last along the board; it will be noticed that considerably more pressure is required to slide it over the chalk than over the smooth part.

THE MAKING OF LASTS BY HAND.

We will now consider the practical part of last making by the old hand method, which, as we have already indicated, is rapidly becoming obsolete. Assuming that beech is the material employed and a hand-sewn last required, the following would be the operations, in order:—

The spokes are sawn into pieces of about 1ft. in length, from which, of course, a single last may be made. The pieces are then sorted into pairs of pieces, both of which will most conveniently cut bark bottoms or bark sides. The reason for this will have been made evident in previous sections (see pages 15-17).

Chopping the block is the next operation; that is, the piece of wood, previously sawn into something near the length required, is chopped with the coachmaker's axe (fig. 10, p. 22) roughly into shape (see fig. 4, p. 10), having regard to the pitch and spring required in the last. This operation requires care and dexterity, and it is astonishing how proficient some workmen are in the use of the axe, thereby saving much time and labour. The block prepared so far is called a chopped block, and is ready for knifing. Fig. 3 shows a French block, as imported; this, too, is called a chopped block.

Knifing is the next process, and by it the chopped block is brought still nearer to the form desired. The last maker grasps the knife firmly by the handle, and, holding the chopped piece in the left hand with one end resting on the bench, steadying it also by the left knee or thigh, he can make a firm, clean cut. He would generally pare off large pieces at first and smaller and finer ones as the wood gradually assumed the shape desired.

The roughed piece, as it is called at this stage, should be left 1 size larger than the last is required to be, and $\frac{3}{8}$ inch

larger in fitting, the latter allowance providing $\frac{1}{8}$ inch for loss in sawing down the block and $\frac{1}{4}$ inch for rasping and finishing off.

It is during the operation of knifing that the proper pitch and spring are given to the last, according to the height of heel it is intended to provide for; also the proper width of forepart and heel, and shape of the waist, etc., hence frequent testing with the size-stick and tape is necessary.

If the workman is provided with insole patterns, he can test them on the partially-finished last, so as to get the proper shape of toe and general formation of the bottom. In working to a pattern last a keen and practised eye is necessary in order to correctly imitate the shape of the toe and the curves at other points.

THE BLOCK IS SAWN DOWN next (see fig. 9, page 20). For this operation the last is firmly fixed in the vice, either quite upright or nearly horizontal, plenty of chalk being used to prevent slipping, and either the up-and-down saw (fig. 11, page 22) or bow saw (fig. 9, page 20) may be used. Some last makers do not trouble to mark the last where they intend to cut the block, but rely upon their experience; others keep a curved strip of leather for marking the roughed last with. For the sake of accuracy and symmetry it would seem desirable to mark out the block in all cases.

A tenon saw is used to finally sever the block, by a straight cut across the front.

A steel point, American wire nail, or ordinary nail is next driven into the under side of the severed block, until it is left projecting about $\frac{3}{8}$ inch, and the projecting portion is then sharpened with a file. The block being again placed in proper position on the last, it is struck with a hammer, so as to firmly fix it and prevent shifting during the later operations of rasping, etc.

HOLES ARE DRILLED in the back part of the block and last respectively at this stage, with brace and bit—the one for drawing out the block and the other for drawing out the last from a boot during the making (see figs. 7 and 8, page 17).

A round-headed screw is passed through the hinder part of the block into the lower part of the last, to hold both toge-

ther during use; this may be adjusted now (see fig. 7, page 17).

Some last makers give the last a second knifing after sawing the block, before proceeding to the process of rasping.

Rasping.—The last is again fixed in the vice, and carefully gone all over with the rasp, to take out the knife marks, and still more accurately develop the shape, particularly at the toe, which is perhaps the part requiring most care of any. The last is alternately held in the hand and vice, and frequently tested in regard to measurements, width of sole, etc.

Scraping comes next. The last is again fixed in the vice, and the workman, holding the coarse scraper by both hands, commences to take out the marks made by the rasp. He would generally commence at the sides, then do the top, and finally the bottom, working the scraper towards or from him, according to the direction of the grain in the wood.

The fine scrapers are next used in a similar manner to take out any marks left by the coarse scraper or rasp, particularly in the deeper parts of the curves. Of course, greater care is required as the work progresses to prevent indenting the last by the vice; high insteps in particular require attention. A liberal use of chalk on the freshly-rasped grip-pieces of the vice will considerably help to prevent, or modify, any impressions.

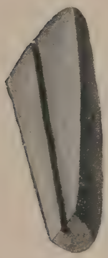
Finishing.—The finishing touch to an ordinary last is generally given with sand or glass paper, though occasionally lasts are rubbed with a deer bone afterwards. Lasts burnished with deer bone certainly look very nice, but, as the fibres are only rubbed down, and there is nothing to keep them there, the lasts soon lose their polished appearance on being used; on this account it is generally considered an unnecessary trouble, and seldom done now. Deer bone seems to have decided advantages over any other bone for the purpose named, as, besides being tolerably long and slender, the fatty matter retained in it seems to retard the outer surface getting dry and hard.

MAKING OF MODELS BY HAND.

In the construction of models to serve as patterns for iron lasts the preliminary operations are exactly the same as for a stitch last, and it is only in the later stages of the work that modifications are adopted.

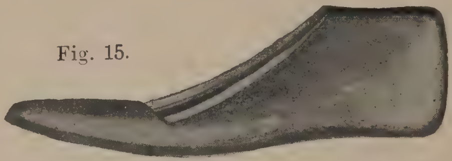
Allowance for Shrinkage.—In consequence of the fact that iron contracts on cooling, the models must be made a little longer than the last is required. Experience shows that an allowance of $\frac{1}{8}$ inch to the foot leads to satisfactory

Fig. 14.



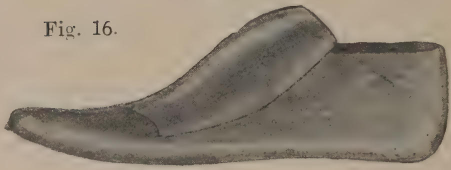
BLOCK.

Fig. 15.



MODELS

Fig. 16.



results, so that a bare $\frac{1}{8}$ inch is allowed for men's lasts, and less for women's and youths'. No allowance is made in width, because it would be proportionately less in amount, say about one-third of the allowance in length, i.e., about 1-24 inch, and the slight tapping necessary to ease the model, so that it can be withdrawn from the mould, gives a sufficient amount. (See section on making of iron lasts.)

The top part of the model is made differently to that of an ordinary last, to allow of a slot being made in the back part of the iron last for fitting the latter on to the rivetter's stand. The block, too, is cut more forward, and a narrow strip of wood $\frac{1}{2}$ inch wide and $\frac{1}{4}$ inch thick is tacked on to the part of the last from which the block has been removed (see figs. 14 and 15). The strip should be undercut a little,

so that the block may remain fixed when placed on the last, though this is not always done. It is more necessary with iron blocks than with wooden ones. A groove is made in the block, corresponding in position with the strip on the last (see figs. 14 and 15), so that the two parts may fit together and keep in position, as a similar block may have to do on the iron last afterwards (see fig. 16). This is still the practice by most last makers, though some parts of it are unnecessary, as will be seen by reference to the section on casting of iron lasts.

Since a single pair of models may be used as patterns for a large number of iron lasts, they should be prepared with extreme care, and after they have been finished off with sandpaper they should always be French polished, to prevent the actual wetting of the wood, and consequent swelling of the model, or frizing of the grain, by contact with the damp sand of the mould.

LASTS FOR WELTED WORK.

Lasts for welted work are made of wood in the same manner and of the same form as ordinary hand-sewn lasts, with the exception that the block is cut as for a model, in order to allow for the insertion of an iron tube. All welted work is made on special lasting jacks, because an ordinary iron stand would be too large for a wooden last to go on with safety, the wood being rather thin where the iron upright could be inserted. These lasts are provided with galvanised iron heel plates to clench the heel tacks on.

FINISHING LASTS.

The making of finishing lasts differs very little from the making of ordinary lasts, whether by hand or machine; therefore, no description need be given. Any of the woods used for lasts would be suitable.

A finishing last should be half a size shorter and one fitting less than an ordinary last, so that it may be inserted

and withdrawn from a boot without undue straining of the material or stitches. Boots made of light material may be finished on a rather larger last with advantage, as it keeps the toe out well. Handsewn boots are finished on the same last on which they are made.

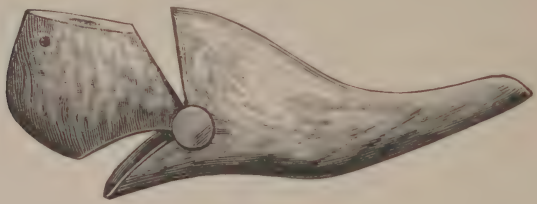


Fig. 17.
HINGED FINISHING LAST.

Hinged Last.—The latest, and, we believe, the best, finishing last on the market is the hinged last, or "toggle" last, invented by Mr. Bostock, of Stafford. The figure below (fig. 17) gives a better idea of its construction and of its utility than any verbal description.

Some of the subterfuges for finishing lasts, such as filling in with rags, etc., must be very strongly condemned, and the practice of filing down old lasts for the purpose cannot be recommended. There is no doubt that finishing lasts must be carefully graded and well made where the best character of work is aimed at.

EASY-EXIT LASTS.

In order to facilitate the withdrawal of a last from the boot being made upon it various devices have been adopted. Messrs. Mobbs and Lewis, of Kettering, have kindly lent us a block to illustrate their patent iron easy-exit last (see fig. 18). The hinder portion of the last is hinged on to the

forepart, and when the latter has been pressed home the hind portion is pressed down, and at the moment the last

Fig. 18.
EASY-EXIT LAST.

is fully extended the parts automatically lock, and the last is quite rigid until the parts are released by a key.

BLOCKS FOR BLOCKERS, ETC.

Blocks for the blocking of Wellington, Chelsea, and shoe fronts, and the dummies and blocks for closers, are all made by the last maker. Suitable beech planks, from $1\frac{3}{4}$ to 2 inches in thickness, are selected, and the shape of the required blocks marked upon them in pencil. The wood should be sawn with a band saw, and then knifed, rasped, and scraped, as in the making of lasts. The edge that is to receive the leather is carefully bevelled off as required. Well-seasoned wood is as necessary for blocks as for lasts, though not on account of shrinkage so much as warping. The blocks when finished are usually about 1 inch to $1\frac{1}{4}$ inch in thickness.

TREATMENT OF FLAWS, ETC.

A shoe manufacturer will generally expect, and insist on having, perfect lasts; nevertheless, flaws in some parts of a last are not any great drawback if properly treated. The usual plan is to mix sawdust, chalk, and glue as a filling

material for knot holes, with or without colouring matter, as required.

For filling up holes made by tacks in lasts or blocks, various compositions are used similar to the above, with, very frequently, the addition of guttapercha. These compositions are usually looked upon as trade secrets.

MACHINERY FOR LAST MAKING.

When the First Edition of this handbook was published, in 1890, American machinery was gradually displacing last making by hand, and English machines. The replacement is now so nearly complete that the following description of an old last-making machine is only useful from an evolutionary and historical point of view.

Early Form of English Last-Making Machine.—Improvements in machinery for numerous operations in bootmaking have come on so rapidly that "early" must not be taken to imply centuries, but less than a quarter of one century, perhaps.

The machine figured (fig. 19) was actually a copying machine, as, indeed, are all the more modern ones, and in several respects resembles an ordinary lathe, the essential differences being that the last must be turned from a model or pattern, and the knife used is a working part of the machine.

Construction.—This machine can only be worked by power, as a great velocity against considerable resistance is required; therefore a firm and rather massive wooden frame, or an iron one, as the case may be, must be provided, and on this the chief working parts of the machine rest.

On the top of the frame—or bed, as it is called—nearest the operator there is a second bed, or frame, called the rocking-bed. This latter can be raised or lowered, and be made to rock on pivots situate at its hinder part, one at each end. It carries the model and the rough piece of wood to be turned,

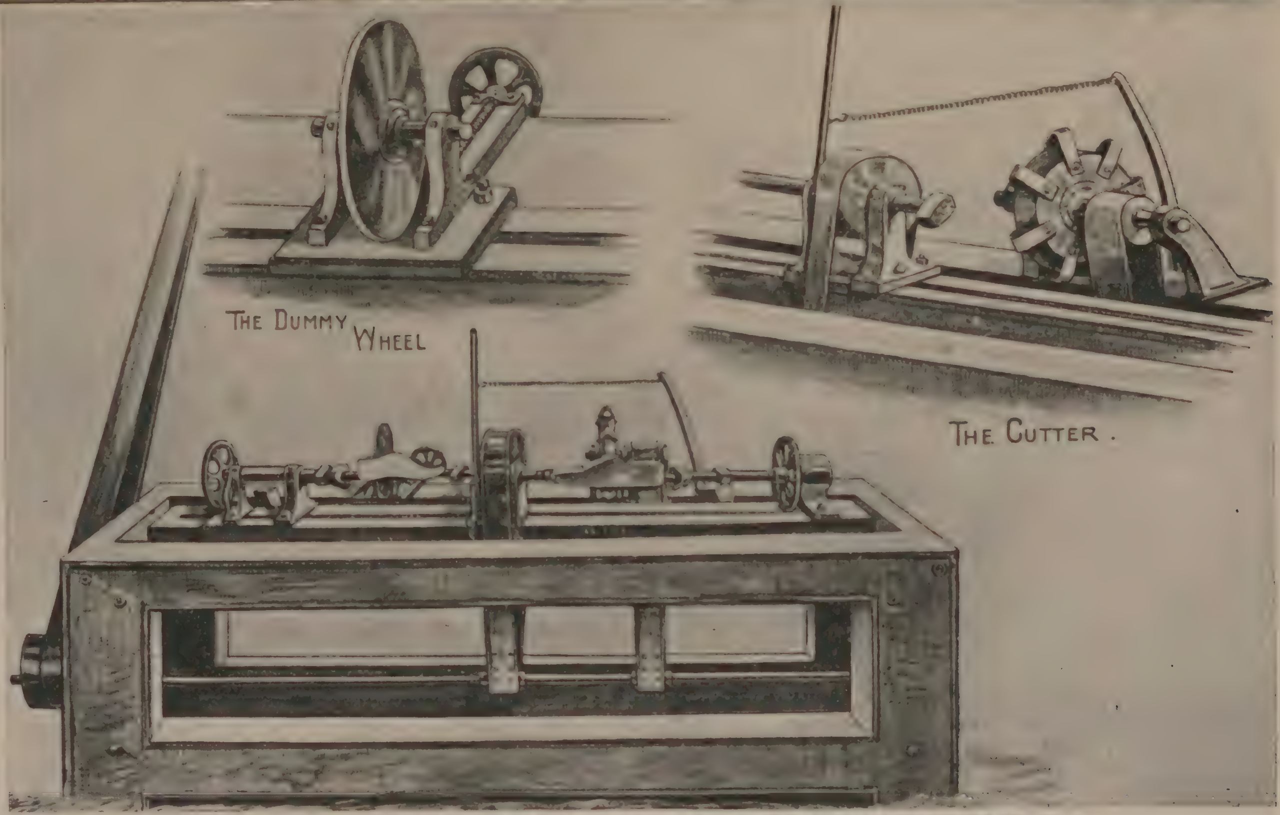


Fig. 19.—EARLY FORM OF LAST-MAKING MACHINE (ENGLISH).

C

both of which are caused to revolve on their longest axes, when the bed is in place, by means of a counter shaft running from the main shaft. Both shafts are situated below the bed of the machine.

At the back of the rocking-bed is a smooth iron rest, called a dummy, and the knives, which latter consist of small steel cups, or cylinders, fixed on the circumference of a wheel. The knives are driven by a pulley from the main shaft at the rate of about 2,500 revolutions a minute, this speed being obtained by means of a drum on the main shaft. The most forward part of the knives and the dummy would be exactly in line with each other if a last the same size as the model were required, and the machine could complete it; but since the last is left covered with grooves where the knives have cut it, and will require rasping and finishing after it leaves the machine, it must be turned a little larger to allow for this, and so either the dummy must come a little more forward or the model be a little larger than the required last.

Both the dummy and knives have a horizontal motion parallel to the plane of the rocking-bed, but are immovable in a direction at right angles to this when fitted for work. It follows, therefore, that anything projecting beyond the plane in which these two lie will be cut off on passing the knives.

Preparation of Model and Block.—Models or patterns for this last-making machine must be specially prepared by hand. They are knifed and rasped in the ordinary way, with the exception that some wood is left on the toe, cut off square, so that the last can be securely fixed and accurately centred in the machine; further finishing is not necessary. Of course, the block is not sawn. Round iron hob nails are driven into the edge of the bottom, round the forepart and heel, and they are filed down to make a square edge like the last would have without them. This is done to prevent the wearing away of the edges by constant friction against the dummy. The model should be made in the first instance rather larger than the last required, say $\frac{1}{4}$ inch or $\frac{3}{8}$ inch, because the latter will require rasping and finish-

ing after it leaves the machine. A satisfactory rule is to make the model 1 fitting over what is required in the last, i.e., for a 3 fitting last use a 4 fitting model. One model will do for both a right and left foot last, also various fittings can be turned from the same model by shifting the dummy, forward for larger and backward for smaller ones. Some last makers, however, prefer to have a model for each fitting, because, with the machine any increase or decrease is exactly the same all over the last, a condition not exactly what is required.

The chopped block to be converted into a last is cut a little longer than if required for a hand-made last, because of fixing in the lathe.

Generally, where there is a last-making machine, the power is available, and used, for a steam saw, which latter is useful in preparing the wooden blocks for the machine. A band saw, too, is a very useful addition for cutting the block.

To Work the Machine.—A model last is first fixed on one side of the rocking-bed opposite the dummy, and the chopped or sawn block opposite the knives (see fig. 19; the pulley from the main shaft is then run on, thus starting the machine; next the rocking-bed or frame is raised till the model touches the dummy, and the block, consequently, is caught by the knives; an indiarubber band is then slipped over the rocking-frame to keep the model well up to the dummy, and the machine is allowed to work until the dummy and knives have traversed the model and block respectively, with the exception of a small piece at each end which has to be finished off by hand. The raising of the rocking-frame causes the band connecting it with the counter-shaft to tighten, and so brings about a revolution of the model and block. The strain in this direction is nearly balanced by a weight acting as a counterpoise.

The model and block are kept revolving, then, whilst the dummy and knives move over them respectively from end to end. As the rocking-frame, carrying both the model and block moves in and out, according to the inequalities of the model pressing against the dummy, so the knives will cut

more or less deeply into the block opposite them, thus producing a very creditable copy of the original, so far as shape is concerned.

The dummy and knives, although immovable from front to back when the machine is at work, can and do move from right to left, or left to right, or one one way and the other the reverse, on a long compound screw, one part working within the other. When the screw works as a whole the dummy and knives move in the same direction, and a last representing the same foot as the model is produced; when both screws are at work the dummy and knives move in opposite directions, and a right-foot last is produced from a left-foot model, or vice versa.

Much the same form of machine is used largely in other trades—cabinet-making, for instance; it is also commonly used for making gunstocks, carriage spokes, brush handles, etc.

AMERICAN MACHINERY.

The most "up-to-date" machine used in last making is, no doubt, the Gilman improved reverse last lathe. For the figure of this lathe and the description of its fitting-up and use we have to thank Messrs. Gilman and Son, of Springfield, Vermont, U.S.A. In the hands of a good workman it will turn out from 75 to 100 pairs of lasts per day of 10 hours, according to size and fineness of feed.

Directions for Setting-up and Using.—All lathes are put together and carefully tested before leaving the factory; therefore, in setting up, make no alterations in the parts, but find where they fit and are designed to go. Parts that might go in more than one place are marked by dots, chisel marks, or figures. Such marks should be carefully observed when putting together.

(1) Set up the main frame, which consists of two side frames, front sill, back sill, girt, post, and fanboard. Take care that the chisel marks on the sills correspond exactly with those on the side frames.

(2) Set the cutter-head carriage on its ways, and level the frame so that the carriage will bear at all four corners.

(3) Put the braces on the frame as marked.

(4) Set the guide-wheel carriage on its ways, and adjust

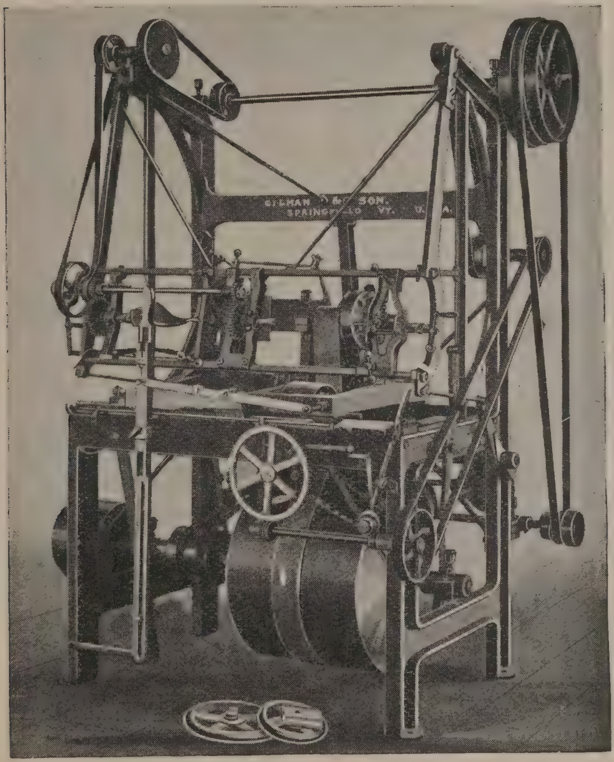


Fig. 20.

GILMAN LAST LATHE.

the stand which gibs it down, so that there will be some friction on the gib-roll.

(5) Put together and hang up the swing frame. Put on the rocking shaft and boxes, and the side rods that connect the swing frame to the rocking shaft. The whole swing frame and connections should oscillate freely.

(6) Take the shafts, pulleys, and the remaining parts, and put all together as shown in the diagram.

The driving-pulleys should make from 450 to 460 revolutions per minute.

The cutter-head is balanced for the set of knives to which is tied the brass cutter-gauge. Sharpen the knives, put them in the head as marked, the knives and bolts being numbered to correspond with the seats in the cutter-head. The cutting edge of the finishing-knife should just reach to the outer notch of the brass gauge. As the cutting edge becomes worn back by use, file the hole in the shank so that it can be kept drawn out to the notch.

To take up end play on the cutter-arbor due to wear, tighten the check-nut on the end of the arbor. Keep the cutter-arbor and other wearing surfaces thoroughly oiled.

Withdraw the sliding stop-pin from the spindle gear at the model end of the swing frame; slide the thick intermediate gear to the right, and the model and block spindles are then free to revolve both in the same direction. Put in the model, sole down, when the gear is in the right position to receive the stop-pin. Screw the toe-dog hard against the model (using spanner-wrench), and fasten it with the thumb-screw. Commence at the toe of the last to turn, always letting back the swing frame gently, until the model touches the guide-wheel.

Set the sliding stop on the shipper-rod so as to automatically stop the feed movement of the carriages at the point desired. Also adjust the slides which regulate the automatic change of speed from fast to slow, and from slow to fast. When it is desired to turn through to the heel without returning to fast speed, slide the cam on the horizontal lever to the extreme left, so that it will not lift the hinged trip. To turn the whole length of the last on fast speed, swing over the hinged trip so that it will not strike the horizontal lever.

To turn the reverse of the model, slide the stop-pin into the hole in the gear. Slide the thick intermediate gear to the left, and the thin gear to the right, fastening the latter with the socket set-screw. Then withdraw the stop-pin.

Put in the block, sole up, and the spindles are ready to revolve—the block spindle in the opposite direction from the model spindle.

For grading in length, the fulcrum pivot in the slot of the grading-lever should be set on the angular-bar at a figure corresponding to the length of the model used; then, by raising or lowering the slide in the grading-lever, the last will be turned longer or shorter than the model, as many sizes as the slide is moved from "o." By varying the position of the fulcrum pivot a different value can be given, if desired, to the grade.

For grading in diameter (width), turn the small bevel-gear shaft which raises and lowers the copper that runs against the fanboard, one turn for each half size. Raising the copper increases the size, lowering it decreases. The slide on the fanboard lever should be set to correspond with the girth of the model. Raising the slide decreases the grade, lowering it increases. In some cases it may be desirable to move the copper more or less than two turns for a size. This depends upon the model used and the amount of grade desired.

Use the medium (No. 2) guide-wheel for turning the size of the model, and one and two sizes (American measure) larger and smaller than the model [one, two, and three sizes French measure (metric system)]. Use the small (No. 1) wheel for turning four and five sizes larger, and the large (No. 3) wheel for turning four and five sizes smaller than the model [five, six, and seven sizes (metric system)].

To "stock up" the last, i.e., to enlarge the turning on all sides alike, move the guide-wheel forward by means of the long screw in the No. 2 wheel-block. This screw can be operated with the long-handled wrench while the last is being turned.

English last makers who use the Gilman last lathe may adopt somewhat different methods to those described below; but these are the American ones kindly supplied to us by Mr. Sherman, of Brockton, U.S.A., late model maker to the Miller Last Co.

The model is prepared with the greatest possible care.

It is first of all turned in the lathe from a model as nearly like the one required as can be found, making an allowance for the sawing of the block and the scouring. All alterations are then made on a small rest known as a "jack," a strap being used to hold the model firm. A spokeshave is used instead of a coarse rasp, and the model is finished off with fine rasps and sandpaper. It is made the exact length that the lasts are intended to be. The model is nailed round the edges, and a toe-plate is put on the bottom.

After the model has been prepared, the insole patterns are carefully graded with a Harford grading machine. The model and patterns then go to the Gilman lathe, and the various sizes and fittings are turned from one pattern in right and left lasts.

After leaving the lathe the lasts go to the band-sawyer, who bores the dowl hole and socket hole, and saws the block down, which latter is then tacked in with a small brad to hold in position temporarily; the hole is then bored for the block fasteners.

The last next goes to the toe-maker, who carefully makes the toes and heels to the patterns, using the size-stick, and very carefully following the model

The next process is to fit the heel plates for welted work, or the iron bottoms for machine-sewn work. After this the block-fastener is carefully put in, and the lasts are ready for scouring.

The first rough-scouring is done on the so-called sand-wheel; the second or middle scouring is done on a finer-grained wheel, and it then undergoes a third and still finer scouring.

The last operation is to give it a fine wax finish by means of a buffing wheel, by which the last is left in a highly-polished state.

CASTING OF IRON LASTS.

Model.—The first consideration is that the model shall be well finished and perfectly smooth, otherwise the sand in which it is moulded will be pulled up when the model is

withdrawn from the mould, and, having to be then replaced by the workman, a more or less faulty copy of the original is likely to result. Models should be varnished to prevent the moisture from the sand causing them to swell.

It is not, in modern practice, necessary for the model maker to fix or supply the dovetail strip to the model, as it is found more convenient to have strips of the required shape made in lead; these can be bent to suit any model, and, as they require to be detached to enable the model to be withdrawn from the sand, nothing is gained by nailing them on. Also, it is not necessary to cut out the dovetail in model blocks, as this is formed by a corebox, an assortment of which is usually kept at foundries where they make lasts.

Moulding Box.—The moulding-box is in two parts, and requires to be well fitted; the meeting edges should be planed, the dowels turned, and the holes into which they fit drilled out, to ensure the two parts of the mould exactly meeting; the lasts will then be cast perfectly true, and without a "fin." This is important, as otherwise, not only would an extra cost be incurred for fettling or trimming the castings, but, also, the last would rust more quickly where trimmed off

Moulding.—One side of the moulding-box is rammed up and sleeked off. The models (of which four men's, five women's, or eight children's go to one box) are placed, sole downwards, upon the flat surface of sand, the other side of the box is then placed in position, and freshly-mixed sand sifted over, until the models are covered. The mould is filled in and rammed, then turned over, and the first side taken off, the sand in which is knocked out, leaving the sole of model upwards in the other half. The sand in this latter portion is taken out with a suitable tool round the waist, following the contour of the model, so that the joint of the two halves of the mould will allow of the model being subsequently withdrawn. Parting sand, which is burnt sand scraped from the surfaces of castings, is then applied, the half box again put in place, and rammed up; it is then taken off, the model loosened in mould, and withdrawn.

Next, the runner-holes and channels to the several impressions are made, cores are inserted for the tack holes in tread of sole, and also for the rivetting stand hole; the two halves of the mould are then put together, and it is ready for the metal to be run in. It is not found necessary to vent moulds for lasts to get rid of gas.

Iron Blocks.—These are cast in advance, using the block of the model for a pattern; the taper dovetail is formed by inserting in the mould a core, made of dry sand, of the requisite shape. When cold the block is coated, where it will come in contact with the last, with a mixture of plumbago and oil, to prevent adhesion.

The model, with its wooden block again attached, is moulded in the ordinary manner, and when it is withdrawn the iron block is inserted into the mould, and fixed by sprigs in the impression left in the mould by the block on model. When the molten metal is poured into the mould it runs into the dovetail formed in the previously-cast block, and when cold the block can be separated from the last by striking the heel of the last smartly on an iron block.

Blacking.—The mould, when ready for casting, and before the two halves of box are finally put together, is dusted over with common finely-ground charcoal. Charcoal is preferable to plumbago for this work, as the latter clings to the casting, and would soil the hands of the laster and the linings of boots for a considerable period.

SHAPES OF LASTS.

Having considered the practical part of last making, we will next briefly examine some of the theories that have been propounded in respect to the proper form of a last.

An ordinary last maker is not, as a rule, consulted about the shape or style of the lasts he is to produce, but is given a pattern one to work to, or, not uncommonly, one to alter a little.

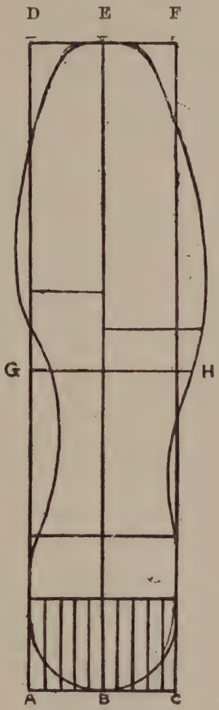
Many surgeons and others have observed and commented on the suffering caused by ill-fitting boots, and a few have

published books or pamphlets on the subject, which, of course, involved a criticism of the shapes of lasts: some of these we may now refer to.

We will first of all notice a small work by Dr. Camper, entitled "On the Best Form of Shoe." This was originally

CAMPER'S.

Fig. 21.



HANNIBAL'S.

Fig. 22.

published many years ago, but a good translation from the French is given in another more recent work, "The Foot and Its Covering," by James Dowie. Some of the strictures passed on shoemakers would, we think, have little significance now; but other matters spoken of are still deserving of consideration.

Peter Camper, M.D., who was Professor of Medicine, Surgery, and Anatomy at Amsterdam and Groningen, says,

in speaking of the sole of the foot:—The toes are naturally all parallel to a line drawn through the middle of the sole and heel, so that in constructing a sole shape a line should be drawn of the length desired, and, the widths at the joint and heel respectively being decided upon, one-half of these measurements should be placed on each side of the central line. He also says that the sole ought to be as broad as possible consistent with a becoming appearance. From one of his diagrams, too, it would appear that the last should be as broad as the foot across the joints.

Dr. Camper next says that the point of the toe should be raised, so as to avoid injury or pain arising from the front of the shoe striking against projecting portions of uneven ground; the heel of moderate height, and placed well forward, so as to support the centre of gravity of the body. He seems to allow a full width of toe, which might be described as a full round, giving extra room to the big toe.

A last formed on this plan would give a very straight-shaped sole, such as is shown in fig. 21.

Meyer's System.—The next important pamphlet we have to refer to is one entitled "Why the Shoe Pinches," by Herman Meyer, M.D., Professor of Anatomy in the University of Zurich. In this small book, published in 1857, Dr. Meyer very clearly describes what he considers to be errors in the usual form of foot-covering, and gives instructions as to how a more suitable shoe might be obtained without prejudice to the ever-primary consideration of elegance.

Dr. Meyer lays down as a principle, when designing a sole shape, that "all feet are perfectly alike in the principle of their mechanical construction." The only differences in healthy feet are those arising from varying length and breadth. In the original form of the foot we never meet with those essential differences designated by shoemakers bent or straight feet, and still less with such variations as arise from the position in which the great toe lies, or from the thickness of the ball at its root—variations of the latter description only indicating how far the foot has been deformed by shoes worn at a former period. For healthy feet, therefore, he considers that a drawing is super-

fluous; it is sufficient to have the length and breadth only given, when a knowledge of the structure of the healthy foot is possessed. He then proceeds to describe how a proper sole may be designed for either foot, the main point to be attended to being that the great toe shall have its normal position, so that those functions which are proper to it may not be interfered with.

Meyer's Line.—We give three figures similar to those occurring in Prof. Meyer's pamphlet. The first, fig. 23, shows the direction the so-called primary line should take,

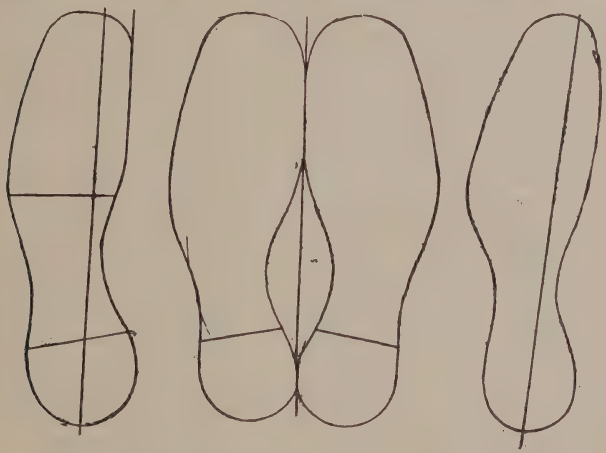


Fig. 23. Fig. 24. Fig. 25.

MEYER'S.

through the middle of the heel and the ball of the great toe and under the middle of the great toe through its entire length. This line is now commonly known as "Meyer's line." In fig. 24 is shown a pair of soles constructed on this principle, the heel and toe touching a straight line between them. If it be desirable to have pointed toes, the pointing must be effected from the outer side, as shown in fig. 25.

In summing up Prof. Meyer's theory we may say that, theoretically, it looks very well, and would seem to provide a sensible and comfortable shape; but, when we come to actual practice, it fails, for it has been proved many times

that boots made on this shape of last have a great tendency to run over, and throw the pressure on the smaller toes, causing bad corns on the tops of them. Certainly, if we were to adopt narrow toes designed in this manner, we should run great risk of becoming hopeless cripples.

ANATOMICAL OR HYGIENIC LASTS.—Lasts more or less resembling the shapes spoken of above are generally known as anatomical or hygienic lasts.

Mr. Alfred Hannibal, the pioneer instructor in Boot and Shoe Manufacture at the London Polytechnic, used a system which he called the "tripod-bearing system," and in his book, "Last Fitting and Pattern Cutting," he contends that all feet are modelled on one principle, the only differences in the feet of various races being in length and bulk, which differences may be attributed to circumstances of climate and locality; therefore, the same general outlines should be observed under all conditions in shaping suitable lasts.

HANNIBAL'S METHOD was as follows:—Assuming that we have a 7's size 3 fitting last to get out, the width of heel being, say, $2\frac{1}{2}$ inches, and of forepart $3\frac{1}{4}$ inches; first draw a line, A C, $2\frac{1}{2}$ inches in length (the width of heel), next divide this line into ten equal parts (or quarters of an inch), and draw perpendiculars to it from the centre and both ends, A D, B E, C F, each the exact length of a 7's last, and finish the parallelogram as shown in fig. 22. Now bisect the centre line by means of a transverse line, G H, so that the whole oblong is halved in two directions at right angles to each other. The next thing is to fix the position of the outside and inside joints. The outside joint is taken at one inch from the centre line, and the inside at $1\frac{3}{4}$ inches from the same, longitudinally (see fig. 22). Having fixed the positions of joints, two of the parts into which A C is divided are added on to the outside joint, and one on to the inside, thus bringing up the required width. From these points any sole shape can be constructed, whether broad, medium, or narrow, keeping the centre line always in the centre of the toes.

It will be noticed that Mr. Hannibal's is a compromise

between Dr. Camper's and Professor Meyer's systems; the soles are not so straight as the former, and not so twisted as the latter. Most English lasts are shaped in this style, and we express the opinion that it is the most practicable method yet introduced, answering all the requirements of ordinary and well-developed feet. When we speak of most English lasts being shaped on this principle, we wish it to be distinctly understood that it is only the general principle that is meant, because almost every manufacturer

Fig. 26. Fig. 27. Fig. 28.

SOLE SHAPES.

makes some slight modification to suit his own fancy, or that of the market he supplies. It would, we think, be of little use to discuss these very numerous and comparatively slight alterations.

The French have for a long time favoured lasts made on Dr. Camper's plan—that is, of a straight form, with very full inside joints. Nearly all the American lasts are made in the same manner, with a good spring in the toe. A last of this description is most suitable for anyone suffering with corns on the smaller toes, as it causes the foot to be thrown

well to the inside, thus relieving the pressure on the outside. In fig. 26 is shown an American men's shape founded on this plan; also in figs. 27 and 28 two ladies' boots showing the same characters.

Dr. Ellis's Method. — One other work we must just refer to — "The Human Foot, Its Form and Structure, Functions and Clothing," by Thomas S. Ellis. This work, one of the latest on the anatomy of the foot, is one of the best; but the latter portion, dealing with the forms of lasts, is, at least, open to criticism. Dr. Ellis appears to be a supporter of Meyer, inasmuch as he advocates the twisted, or what is more commonly known as the "hygienic" shape of sole; he also gives a drawing (page 104) of what he calls the ordinary form of last. We cannot help thinking either that the drawing greatly exaggerates the defects of a modern last, or that the type did not deserve the title of "ordinary," much less of "modern," even in 1889. Further, a drawing is given of his own last as an ideal shape. This last is made quite flat on the outer side, i.e., without either spring or waist, and is not intended to carry, or constructed for carrying, a heel. It is made higher than an ordinary last, so as to come above the ankle bone; also, it is constructed in two parts, a heel and a forepart, which are held together by a long screw extending diagonally through them from a point high up at the back to near the sole. It appears to us that a boot moulded on this shape of last would be more suitable for standing in than for walking.

We cannot agree with Dr. Ellis in doing away with spring in the toe; it is usually considered necessary in order to avoid injury to the toes from walking on unlevel ground; besides, an old boot with a fairly thick sole will generally show a considerable elevation of the toe, from which it is surely fair to conclude that we cannot be far wrong in providing it in the first instance. Another reason for spring in the last is that, with a boot made on a flat last, the constant bending of the foot in the action of walking would cause large and unsightly wrinkles on the upper leather after the boot had been worn a short time,

and these wrinkles would harden after getting wet by rain, or by the perspiration of the foot, and be very liable to injure the foot by abrasion, or to cause corns on the tops of the toes.

On another point that Dr. Ellis deals with we feel it necessary to differ from him—as to the last being made to come above the ankle. This seems to us quite unnecessary, and it would, moreover, entail additional labour in the making, and hence expense. A boot or shoe generally has a tendency to bag just beneath the ankle-bone, and to fit this well the last should be sufficiently thin at this point; the upper being properly cut and drafted will then conform to the shape of the leg and ankle, as it is usually made of a light and pliable material.

Whilst fully agreeing with the author of this work as to the injurious effects of high heels, ladies' boots especially offending in this direction, we would plead on behalf of moderate heels that the waist of the foot is the most tender part of the sole, and to tread suddenly on a sharp stone or other obstacle would be liable to pain or injure this part; a high heel to a certain extent would obviate it. A heel say, $\frac{7}{8}$inch, with a sole of $\frac{1}{4}$inch substance, would give sufficient protection and only raise the foot $\frac{5}{8}$inch behind.

In concluding our notice of some of the more prominent theories in regard to the shapes of lasts, we would venture to remark that last makers and shoemakers generally have to provide a last or shoe which is somewhat of a compromise between the natural form of the foot, an adult foot already somewhat deformed, and the factor fashion which has considerable vagaries. If the last-named factor could be eliminated, there is no doubt that a nearly perfect shoe would soon be evolved, by a process of natural selection, for, almost certainly, acquired deformities are not transmitted by heredity, and, therefore, such deformities would gradually disappear. Meanwhile, we must be content to, as far as possible, minimise the evils arising from people trying to improve upon nature, or hide deformities for which they are themselves responsible.

Pitch and Spring of Lasts.—The meaning of the terms

"pitch" and "spring" has already been given in No. 1 pamphlet.* Having dealt with the question of the shape of the bottom of the last, we next have to consider the structure of lasts for various heights of heel, and the front

Fig. 29.

HEEL TOO HIGH.

spring or spring in the toe. Apparently, a great deal of misconception exists on both these points. Some technical writers state that it requires a certain amount of spring in

Fig. 30.

HEEL TOO LOW.

the toe to carry a given height of heel; for instance, one of these states that it requires $\frac{5}{8}$ inch toe spring to carry a

* "Measurement of the Human Foot and Last Fitting," by Walter J. Lewis.

$1\frac{1}{4}$inch heel. In the first place, we may say that the height of heel in no case has anything to do with the spring of the toe of a last; thus, lasts constructed for the South American trade frequently have a spring in the toe of $1\frac{1}{2}$inch, whereas they carry only $\frac{3}{4}$inch heels. Again, London bespoke makers use lasts to take from 1inch to $1\frac{1}{4}$inch heels, with the toe quite dead, or flat from joint to toe. When taking into consideration the height of heel and spring of toe, the joint is the basis from which to work—that is, the part just under the big toe and ball of the foot, which is situate about one-third of the whole length of the foot from the end of the toe. The front spring will start forward and upwards from this point, and, if the last is to carry a heel, the pitch or back spring will go backward and upwards into a graceful curve from the same point, the extent varying with the height of heel to be provided for.

When a heel too high for the pitch is put on a boot, the heel will only touch the ground in front (see fig. 29), and when too low only the ground behind (see fig. 30). Supposing the weight of the person is sufficient to compel the heel to touch the ground both back and front, then the boot is distorted With a boot of the first kind a greater, possibly painful, flexure of the waist will result, and with a boot of the second kind the flexure of the waist will be diminished.

Slipper Lasts are generally made with no back spring, but with a rounded and very full waist, only hollowed on the inside; this is done to prevent the quarters of the slipper gaping at the sides, which they certainly would do if made with a hollow waist (see fig. 31).

For this kind of last English makers give from 1inch to $1\frac{1}{4}$inch spring in the toe, the reason being that when the slipper is on the foot the pressure of the foot at the joint of the big toe will straighten the sole, and in so doing draw the quarters at the top quite tight. The big toe itself cannot do this; hence, if the spring commences in front of the joint there is not sufficient pressure, and the top of the slipper will stick out and present an ungainly appearance.

French makers put rather less spring in slipper lasts than do English, and this, we think, is an improvement, because English, and this, we think, is an improvement, because slippers are mostly worn when the foot is in a state of repose, and the necessary pressure to depress the toe is not called into play.

Shoe Lasts.—A shoe last is made very thin at the sides, to allow the quarters of the shoe made upon it to fit very close round the ankle, it is also made flat in the waist,

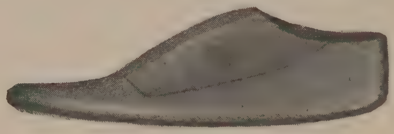


Fig. 31.

SLIPPER LAST.

especially on the outside. If it were made with an arched waist, as soon as the shoe began to be worn, and pressure was put on the waist, the quarters would gape very badly at the sides. A shoe last is given, by many makers, from $\frac{1}{8}$inch to $\frac{1}{4}$inch more front spring than a boot last, in order that the quarters may clip the foot well, as ex-

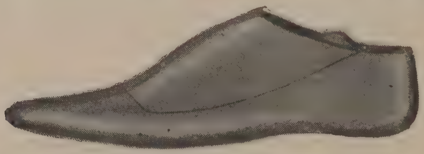


Fig. 32.

SHOE LAST.

plained above, and generally $\frac{1}{8}$inch less measurement on the instep, for a similar reason (see fig. 32). Some manufacturers have all shoe lasts, and use them for both boots and shoes, a plan which has much to recommend it.

Evening and Court Shoes.—A Court shoe last is made very similar to a shoe last, only a little smaller in fitting, generally $\frac{1}{8}$inch., and rather narrower in the bottom, because all turn-shoe work is sewn inside out, and, therefore, gives about $\frac{1}{8}$inch more fitting when turned. They are, as

a rule, made very smart, and kept very thin at the sides. For men's work they are generally made to carry $\frac{1}{2}$inch heels, but for ladies' they run all heights from quite low up to $1\frac{1}{2}$ to 2 inches.

HEAVY BOOTS should have a good spring in the toe, because boots of this kind have stout soles which will not bend as much in the act of walking as the foot would naturally do.

We have already pointed out when and how a last maker begins to develop the proper spring and pitch of a last; but one other matter he has to take into account—he must know and bear in mind the substance of sole of the boots the lasts are intended to be used for. Thus, for a boot to carry a $1\frac{1}{4}$inch heel, and be made of $\frac{1}{4}$inch substance in edge, the last should have 1inch back spring only, it being the practice of the trade not to increase the height of the heel by the whole thickness of the sole where the latter is considerable. Where the substance of sole is $\frac{3}{8}$inch, the heel should be $1\frac{1}{4}$inch to $1\frac{3}{8}$inch in height. As the height of heel increases, the last maker hollows out the waist more and more, in order that the heel may be square, and measure the same in height, both back and front (see fig. 8, page 17).

When we come to lasts requiring $1\frac{1}{2}$inch to $1\frac{3}{4}$inch heels the curve must go up gradually right to the back measuring point, because a sudden and considerable bend in the foot would be painful. The heel in this case would require pitching forward, and would measure less in height in front than at the back. We show in fig. 7 (page 17) an example of this is a ladies' Vienna last with a high wooden heel.

It is a common mistake, when forming this kind of last, to hollow the waist too much. A study of the foot when raised into the position it would have with a high heel will show how the waist should be formed.

Again, it is of no use trying to make riding or jockey boots with $\frac{3}{4}$inch heels on lasts intended to carry $1\frac{1}{4}$inch heels. The maker has no possible chance of making the boots stand in an upright position; also, the heel would be thrown quite out of the square. If the heel is too high

for the last it touches the ground in front only, and if too low it touches behind only (see figs. 29 and 30, page 50). To make good and satisfactory work, therefore, different lasts should be made for different heights of heel, such as shoes, slippers, Court shoes, and riding boots.

Very frequently the ordinary boot last is made to do duty for a shoe last—a course certainly not desirable. The boot last is not hollowed out much at the sides, but is left fuller than a shoe last. This helps to keep the goloshes at the sides in a proper position. Boot lasts generally have from $\frac{1}{2}$inch to $\frac{5}{8}$inch spring in the toe, and carry heels of $1\frac{1}{8}$inch to $1\frac{1}{4}$inch.

Riding Boot Lasts for men's work are generally made to carry a $\frac{7}{8}$inch heel, have quite a flat waist, not much front spring (say, about $\frac{3}{8}$inch at most), and a good rise on the instep, not less than $\frac{1}{2}$inch, but often $\frac{3}{4}$inch. For ladies' work, however, they are made to carry a higher heel than for men's, and they are more arched in the waist.

MEASUREMENTS.

We have now to consider a matter of great importance in connection with last making—that is, measurements.

Three girth measurements are necessary and sufficient for all ordinary lasts, viz., the joint, the instep, and the heel.

The Joint Measurement is taken at about one-third of the whole length of the foot from the most forward toe. Dr. Camper says that several eminent painters give this proportion to the toes, though others give about two-sevenths.

The Instep Measurement is taken at about half the whole length of the last, and in a slightly slanting direction. The instep measure ought really to be taken at a point a little beyond the middle of the last, towards the heel, because the last is actually longer than the foot.

The Heel Measurement is taken from the same point on the instep as the instep measurement right round the heel of the last (see fig. 33). This is an important matter, because, by taking the heel and instep measurements from the same point on the instep, they mutually correct each

other, and so prevent the instep getting too forward or backward.

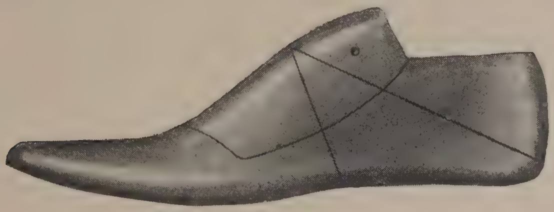


Fig. 33.

Width Measurements are naturally connected with the shapes of the bottoms of lasts, and are usually made at

Fig. 34.

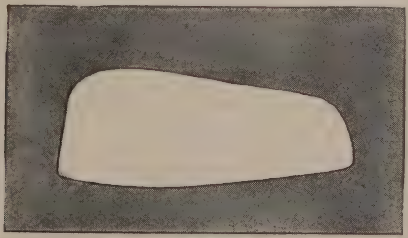


Fig. 35.

SECTIONAL PATTERNS.

three points—the joint or tread, the waist, and the heel. It is of great assistance to a hand last maker to be supplied with accurately-graded insole patterns ir stiff paper, for

he can then try them on each last, and see that the same shape is preserved throughout the set. They are not of the slightest use, however, but rather the reverse, unless carefully cut and accurately ranged.

Sectional Patterns in stiff cardboard can also be supplied to a last maker; these, which are commonly called breech patterns, should give a section such as would be shown by the last itself when cut right through its centre, lengthways (see fig. 34). They must be graded into sets, and the last maker can, of course, test the last by these, as frequently as is necessary, in the later operations of rasping, etc., and see that for each size the spring, arch of the waist, and curve from joint to instep are accurate. If the lasts are peculiar in any way, a close sectional pattern may be supplied, such as is shown in fig. 35.

Owing to the perfection of the modern last lathe, sectional patterns are very rarely required now.

Ranging of Lasts.—In ranging lasts into sets, it has been proved by long experience in practice that a $\frac{1}{4}$inch is a fairly accurate allowance to make, from size to size, at the joint and instep, and we believe this is universally adopted in England.

The joint may be looked upon as the standard measurement. The amount of rise given from joint to instep varies a great deal, some makers only giving $\frac{1}{4}$inch over the joint, others running up to $\frac{3}{8}$inch, $\frac{1}{2}$inch, or even $\frac{3}{4}$inch. It is much to be regretted that there is no general scale in use, at least from the buyers' point of view.

For the sake of the uninitiated it would be as well here to state that lasts are first made into sets, and the same shape is then made in what are called different "fittings," that is, they are made with larger or smaller girth measurements. These fittings are designated by numbers, thus:—

No. 0. Extra narrow.
,, 1. Very narrow.
,, 2. Narrow.
,, 3. Medium.
,, 4. Medium broad.
,, 5. Broad.
,, 6. Extra broad.

The Americans, instead of using figures to denote the various fittings, use the first seven letters of the alphabet:—A, B, C, D, E, F, G, and even run down to what they call double A's and treble A's; but in Europe we believe it is the common practice to use figures, the same as in England.

The terms narrow, medium, and broad vary very much in their meaning in the British Isles; for instance, in London and the South a 3 fitting is generally called a medium fitting, whereas in the North of England and Scotland a last with $\frac{1}{4}$inch to $\frac{3}{8}$inch larger fitting is called a medium one.

SCALES OF FITTINGS.

Many years ago a certain firm of shoe manufacturers, seeing the necessity for some more definite scale of fittings than was then in use, took a record of some hundreds of bespoke measures, and from these deduced an average scale. There is little doubt that this very sensible plan has formed the basis of the scales now in general use, although not strictly adhered to.

In the scales and fittings tabulated we have given a rise of $\frac{3}{8}$inch from joint to instep for the gentlemen's, and $\frac{1}{4}$inch for the youths' and boys'; also $\frac{3}{8}$inch rise for the ladies', and $\frac{1}{4}$inch for the girls'. We believe this table, as far as the joint measurements are concerned, represents the scale of fittings mostly used by manufacturers in this country. A few firms make the joint measurements $\frac{1}{8}$inch larger than this scale. As we have already stated, the instep measurements vary considerably, and to some extent depend on the district the goods are intended for. The scale of fittings following is from 1 fitting to 6 fitting in the gentlemen's and ladies', and 2, 3, and 4 fittings in the youths', boys', and girls'.

ENGLISH SCALE OF JOINT AND INSTEP MEASUREMENTS.

GENTLEMEN'S.

$\frac{3}{8}$inch rise from Joint to Instep.

Size	1 Fitting		2 Fitting		3 Fitting		4 Fitting		5 Fitting		6 Fitting	
	Joint	Instep	Joint	Instep	Joint	Instep	Joint	Instep	Joint	Instep	Joint	Instep
11	$9\frac{1}{4}$	$9\frac{5}{8}$	$9\frac{1}{2}$	$9\frac{7}{8}$	$9\frac{3}{4}$	$10\frac{1}{8}$	10	$10\frac{3}{8}$	$10\frac{1}{4}$	$10\frac{5}{8}$	$10\frac{1}{2}$	$10\frac{7}{8}$
10	9	$9\frac{3}{8}$	$9\frac{1}{4}$	$9\frac{5}{8}$	$9\frac{1}{2}$	$9\frac{7}{8}$	$9\frac{3}{4}$	$10\frac{1}{8}$	10	$10\frac{3}{8}$	$10\frac{1}{4}$	$10\frac{5}{8}$
9	$8\frac{3}{4}$	$9\frac{1}{8}$	9	$9\frac{3}{8}$	$9\frac{1}{4}$	$9\frac{5}{8}$	$9\frac{1}{2}$	$9\frac{7}{8}$	$9\frac{3}{4}$	$10\frac{1}{8}$	10	$10\frac{3}{8}$
8	$8\frac{1}{2}$	$8\frac{7}{8}$	$8\frac{3}{4}$	$9\frac{1}{8}$	9	$9\frac{3}{8}$	$9\frac{1}{4}$	$9\frac{5}{8}$	$9\frac{1}{2}$	$9\frac{7}{8}$	$9\frac{3}{4}$	$10\frac{1}{8}$
7	$8\frac{1}{4}$	$8\frac{5}{8}$	$8\frac{1}{2}$	$8\frac{7}{8}$	$8\frac{3}{4}$	$9\frac{1}{8}$	9	$9\frac{3}{8}$	$9\frac{1}{4}$	$9\frac{5}{8}$	$9\frac{1}{2}$	$9\frac{7}{8}$
6	8	$8\frac{3}{8}$	$8\frac{1}{4}$	$8\frac{5}{8}$	$8\frac{1}{2}$	$8\frac{7}{8}$	$8\frac{3}{4}$	$9\frac{1}{8}$	9	$9\frac{3}{8}$	$9\frac{1}{4}$	$9\frac{5}{8}$
5	$7\frac{3}{4}$	$8\frac{1}{8}$	8	$8\frac{3}{8}$	$8\frac{1}{4}$	$8\frac{5}{8}$	$8\frac{1}{2}$	$8\frac{7}{8}$	$8\frac{3}{4}$	$9\frac{1}{8}$	9	$9\frac{3}{8}$

YOUTHS'.

¼inch rise from Joint to Instep.

Sizes	2 Fitting		3 Fitting		4 Fitting	
	Joint	Instep	Joint	Instep	Joint	Instep
5	8	8¼	8¼	8½	8½	8¾
4	7¾	8	8	8¼	8¼	8½
3	7½	7¾	7¾	8	8	8¼
2	7¼	7½	7½	7¾	7¾	8

BOYS'.

¼inch rise from Joint to Instep

Sizes	2 Fitting		3 Fitting		4 Fitting	
	Joint	Instep	Joint	Instep	Joint	Instep
1	7⅛	7⅜	7⅜	7⅝	7⅝	7⅞
13	6⅞	7⅛	7⅛	7⅜	7⅜	7⅝
12	6⅝	6⅞	6⅞	7⅛	7⅛	7⅜
11	6⅜	6⅝	6⅝	6⅞	6⅞	7⅛

LITTLE BOYS'

⅛inch rise from Joint to Instep.

Size	2 Fitting		3 Fitting		4 Fitting	
	Joint	Instep	Joint	Instep	Joint	Instep
10	6¼	6⅜	6½	6⅝	6¾	6⅞
9	6	6⅛	6¼	6⅜	6½	6⅝
8	5¾	5⅞	6	6⅛	6¼	6⅜
7	5½	5⅝	5¾	5⅞	6	6⅛

LADIES'

$\frac{3}{8}$ inch rise from Joint to Instep.

Size	1 Fitting Joint	1 Fitting Instep	2 Fitting Joint	2 Fitting Instep	3 Fitting Joint	3 Fitting Instep	4 Fitting Joint	4 Fitting Instep	5 Fitting Joint	5 Fitting Instep	6 Fitting Joint	6 Fitting Instep
7	8	$8\frac{3}{8}$	$8\frac{1}{4}$	$8\frac{5}{8}$	$8\frac{1}{2}$	$8\frac{7}{8}$	$8\frac{3}{4}$	$9\frac{1}{8}$	9	$9\frac{3}{8}$	$9\frac{1}{4}$	$9\frac{5}{8}$
6	$7\frac{3}{4}$	$8\frac{1}{8}$	8	$8\frac{3}{8}$	$8\frac{1}{4}$	$8\frac{5}{8}$	$8\frac{1}{2}$	$8\frac{7}{8}$	$8\frac{3}{4}$	$9\frac{1}{8}$	9	$9\frac{3}{8}$
5	$7\frac{1}{2}$	$7\frac{7}{8}$	$7\frac{3}{4}$	$8\frac{1}{8}$	8	$8\frac{3}{8}$	$8\frac{1}{4}$	$8\frac{5}{8}$	$8\frac{1}{2}$	$8\frac{7}{8}$	$8\frac{3}{4}$	$9\frac{1}{8}$
4	$7\frac{1}{4}$	$7\frac{5}{8}$	$7\frac{1}{2}$	$7\frac{7}{8}$	$7\frac{3}{4}$	$8\frac{1}{8}$	8	$8\frac{3}{8}$	$8\frac{1}{4}$	$8\frac{5}{8}$	$8\frac{1}{2}$	$8\frac{7}{8}$
3	7	$7\frac{3}{8}$	$7\frac{1}{4}$	$7\frac{5}{8}$	$7\frac{1}{2}$	$7\frac{7}{8}$	$7\frac{3}{4}$	$8\frac{1}{8}$	8	$8\frac{3}{8}$	$8\frac{1}{4}$	$8\frac{5}{8}$
2	$6\frac{3}{4}$	$7\frac{1}{8}$	7	$7\frac{3}{8}$	$7\frac{1}{4}$	$7\frac{5}{8}$	$7\frac{1}{2}$	$7\frac{7}{8}$	$7\frac{3}{4}$	$8\frac{1}{8}$	8	$8\frac{3}{8}$

GIRLS'.

$\frac{1}{4}$ inch rise from Joint to Instep.

Sizes	2 Fitting		3 Fitting		4 Fitting	
	Joint	Instep	Joint	Instep	Joint	Instep
1	$6\frac{7}{8}$	$7\frac{1}{8}$	$7\frac{1}{8}$	$7\frac{3}{8}$	$7\frac{3}{8}$	$7\frac{5}{8}$
13	$6\frac{5}{8}$	$6\frac{7}{8}$	$6\frac{7}{8}$	$7\frac{1}{8}$	$7\frac{1}{8}$	$7\frac{3}{8}$
12	$6\frac{3}{8}$	$6\frac{5}{8}$	$6\frac{5}{8}$	$6\frac{7}{8}$	$6\frac{7}{8}$	$7\frac{1}{8}$
11	$6\frac{1}{8}$	$6\frac{3}{8}$	$6\frac{3}{8}$	$6\frac{5}{8}$	$6\frac{5}{8}$	$6\frac{7}{8}$

GIRLS'.

$\frac{1}{4}$ inch rise from Joint to Instep.

Sizes	2 Fitting		3 Fitting		4 Fitting	
	Joint	Instep	Joint	Instep	Joint	Instep
10	6	$6\frac{1}{4}$	$6\frac{1}{4}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{4}$
9	$5\frac{3}{4}$	6	6	$6\frac{1}{4}$	$6\frac{1}{4}$	$6\frac{1}{2}$
8	$5\frac{1}{2}$	$5\frac{3}{4}$	$5\frac{3}{4}$	6	6	$6\frac{1}{4}$
7	$5\frac{1}{4}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{3}{4}$	$5\frac{3}{4}$	6

INFANTS'.

$\frac{1}{8}$ inch rise from Joint to Instep.

Size	Joint	Instep
6	$5\frac{3}{8}$	$5\frac{1}{2}$
5	$5\frac{1}{8}$	$5\frac{1}{4}$
4	$4\frac{7}{8}$	5

It will be observed that the larger and smaller fittings are made by increasing or decreasing by a quarter-of-an-inch, so that any fitting not given can be worked out on this system.

HEEL MEASUREMENT.—The heel measurement depends upon both the rise given to the instep and the shape of the last, and particularly the character of the waist; hence it is impossible to give a satisfactory scale of heel measures, but, having decided on the heel measure of a standard last, the larger and smaller sizes should be increased or diminished half-an-inch in the gentlemen's, and three-eights of an inch in the ladies', youths', boys', and girls', respectively, carefully observing the precaution indicated on page 55.

BOTTOM WIDTHS.—The subject of bottom widths is one on which great differences of opinion exist, and, consequently, various modes of procedure are adopted by manufacturers. We do not think it advisable to give a tabulated scale of widths for all the sizes—although it would be quite possible to construct one—as it would be very complicated. One or two of the simple plans adopted by last makers are, however, appended.

SCALE OF BOTTOM WIDTHS.

GENTLEMEN'S (Size 7's).

	2 Fitting	3 Fitting	4 Fitting	5 Fitting	6 Fitting
Joints . . .	$3\frac{1}{12}$	$3\frac{2}{12}$	$3\frac{3}{12}$	$3\frac{4}{12}$	$3\frac{5}{12}$
Heels . . .	$2\frac{3}{16}$	$2\frac{4}{16}$	$2\frac{5}{16}$	$2\frac{6}{16}$	$2\frac{7}{16}$

Joints to increase from size to size 1-12inch.
Heels ,, ,, ,, 1-16inch.

LADIES' (Size 4's).

	2 Fitting	3 Fitting	4 Fitting	5 Fitting	6 Fitting
Joints . . .	$2\frac{6}{12}$	$2\frac{7}{12}$	$2\frac{8}{12}$	$2\frac{9}{12}$	$2\frac{10}{12}$
Heels . . .	$1\frac{13}{16}$	$1\frac{14}{16}$	$1\frac{15}{16}$	2	$2\frac{1}{16}$

Joints to increase from size to size 1-12inch.
Heels ,, ,, ,, 1-16inch.

YOUTHS' (Size 5's).

	2 Fitting	3 Fitting	4 Fitting
Joints . . .	$2\frac{8}{12}$	$2\frac{9}{12}$	$2\frac{10}{12}$
Heels . . .	$1\frac{15}{16}$	2	$2\frac{1}{16}$

Joints to increase from size to size 1-12inch.
Heels ,, ,, ,, 1-16inch.

No. 1 fitting is, as a rule, made the same width as a 2 fitting.

SUMMARY OF ENGLISH SCALES, ETC.

GIRTH MEASUREMENTS.

RISE FROM JOINT TO INSTEP.

Gentlemen's (11's to 5's) ...	$\frac{3}{8}$inch.	Ladies' (7's to 2's)... ...	$\frac{3}{8}$inch.
Youths' (5's to 2's)	$\frac{1}{4}$inch.	Girls' (1's to 11's)... ...	$\frac{1}{4}$inch.
Boys' (1's to 11's)	$\frac{1}{4}$inch.	,, (10's to 7's)... ...	$\frac{1}{4}$inch.
Little boys' (10's to 7's) ...	$\frac{1}{8}$inch.	Infants' (6's to 4's) ...	$\frac{1}{8}$inch.

Allowance from size to size $\frac{1}{4}$inch, except as shown below :

From youths' 2's to boys' 1's ... ... $\frac{1}{8}$inch instead of $\frac{1}{4}$inch.
,, boys' and girls' 11's to 10's .. ,, ,, ,,
,, girls' 7's to infants' 6's ... ... ,, ,, ,,

These variations from the regular gradation are made to prevent the smaller sizes being too narrow.

Heel measurements ½inch from size to size in gentlemen's, and ⅜inch in ladies', youths', and boys'.

BOTTOM WIDTHS.

	Gent.'s.	Ladies'.
Increase or decrease of joint from size to size ...	1-12inch.	1-12inch.
,, ,, heel ,, ,, ...	1-16inch.	1-16inch.
,, ,, joint from fitting to fitting	1-12inch.	1-12inch.
,, ,, heel ,, ,,	1-16inch.	1-16inch.

We have given the preceding scales of fittings the title of "English" because we believe that they more nearly represent the general practice of the trade than any others that could be prepared; but it must be distinctly understood that they are not presented as perfect scales. For instance, a perfect scale would have no irregularities in it such as occur at three points in that of girth measures. On behalf of the scale as presented we may, however, say that it presents no awkward fractions, such as would be required if a regular gradation of fittings from the smallest to the largest sizes were attempted. Of course, scales might be prepared for use without using figures, which would be mathematically correct, a separate scale being used for each kind of measurement. Mr. C. F. Alden, of Norwich, has invented and published a method of this kind; but manufacturers are, naturally, very slow to adopt a new method, even though an improvement on the older ones, if the new method necessitates great changes in their lasts and patterns, particularly when no such change is demanded by their customers.

In regard to the modifications adopted by different manufacturers, one only need be referred to. Some, instead of giving a regular increase or decrease from joint to instep, in gentlemen's lasts, throughout the six fittings, only do so for the medium ones, and reduce the increase by ⅛inch for each larger fitting, and increase it by ⅛inch in each smaller one, because they consider that the instep does not increase or decrease as much as the joint in the same "size"

of foot. They would adopt the same principle in all the other sizes, except, perhaps, the little boys' and girls'.

FOREIGN SIZES AND FITTINGS.

As far as we have been able to ascertain, the French methods of measurement are almost universally employed in Germany, Spain, Austria, and Italy, as well as France; but we have not been able to get any information in regard to Russia.

Some of the figures to follow will, perhaps, be rendered more intelligible if we give a comparison of the English and French units here.

ENGLISH SIZES.

$\frac{1}{3}$inch each, i.e., 15 in 5 inches ... ... 5-15inch each.

PARIS POINTS, OR FRENCH SIZES.

15 in 4 inches... ... ... 4-15inch each.

CENTIMETRES.

A centimetre is very nearly 2-5inch, so that 2-3 of a centimetre—sometimes used as a size—is practically a French point, or ... 4-15inch.

The French system of measurements is applied in three different ways, as shown below:—

1st.—The old Paris points or sizes are used for the length measures, starting from 1, and the same unit for the girth. Under this system some makers give two-thirds, and others three-fourths of the aforesaid point, from size to size, at the joint and instep.

2nd.—The centimetre is used throughout, two-thirds of the centimetre constituting a size, an allowance of half-a-centimetre being made from size to size at the joint and instep.

Some makers use half-centimetres for the length measures, and one-third for the girths.

3rd.—A combination of the two systems is frequently used—Paris points for lengths, and half-centimetres for the

girths. Reference to the comparison of units above will shows that this is, practically, the same as the 2nd.

The advantage of either of the three methods noted above, over the English, is that with it there can be a regular gradation in the girth measurements, from the smallest size to the largest, because smaller units are used.

In France a good number of "straights" are used, both for gentlemen's and ladies' work—that is, lasts intended for making both shoes alike, only one last being required for both feet (see fig. 35). For these, Mr. Pabst, last maker of

Fig. 36.

Hamburg, says* two of the above systems are adopted, the one using Paris points for length, and two thirds of such points for girth measures, and the other half-centimetres for length, and one-third-centimetres for girth measures.

We may here mention that the straight shape above referred to has been a great favourite in the past with the French people, and has been a specialty with a well-known Paris house, M. Pinet, whose productions have a good reputation, and have been largely sold in this country.

We now give a German scale, as published by Herr Busch, of Erfurt. It gives the Paris points for length, and centimetres for fittings, and we think it is an excellent scale of measurements. It would appear from this scale that the Germans require rather full-fitting lasts.

* Catalogue of Last Measurements.

GERMAN SCALE OF SIZES AND FITTINGS

MEN'S.

Sizes.	1 Fitt.		2 Fitt.		3 Fitt.		4 Fitt.		5 Fitt.		6 Fitt.	
	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.
45	24	24½	24½	25	25	25½	25½	26	26	26½	26½	27
44	23½	24	24	24½	24½	25	25	25½	25½	26	26	26½
43	23	23½	23½	24	24	24½	24½	25	25	25½	25½	26
42	22½	23	23	23½	23½	24	24	24½	24½	25	25	25½
41	22	22½	22½	23	23	23½	23½	24	24	24½	24½	25
40	21½	22	22	22½	22½	23	23	23½	23½	24	24	24½
39	21	21½	21½	22	22	22½	22½	23	23	23½	23½	24
38	20½	21	21	21½	21½	22	22	22½	22½	23	23	23½
37	20	20½	20½	21	21	21½	21½	22	22	22½	22½	23
36	19½	20	20	20	20½	21	21	21½	21½	22	22	22½

LADIES'.

Sizes	0 Fitt.		1 Fitt.		2 Fitt.		3 Fitt.		4 Fitt.		5 Fitt.		6 Fitt.		7 Fitt.	
	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.
43	22½	23	23	23½	23½	24	24	24½	24½	25	25	25½	25½	26	26	26½
42	22	22½	22½	23	23	23½	23½	24	24	24½	24½	25	25	25½	25½	26
41	21½	22	22	22½	22½	23	23	23½	23½	24	24	24½	24½	25	25	25½
40	21	21½	21½	22	22	22½	22½	23	23	23½	23½	24	24	24½	24½	25
39	20½	21	21	21½	21½	22	22	22½	22½	23	23	23½	23½	24	24	24½
38	20	20½	20½	21	21	21½	21½	22	22	22½	22½	23	23	23½	23½	24
37	19½	20	20	20½	20½	21	21	21½	21½	22	22	22½	22½	23	23	23½
36	19	19½	19½	20	20	20½	20½	21	21	21½	21½	22	22	22½	22½	23
35	18½	19	19	19½	19½	20	20	20½	20½	21	21	21½	21½	22	22	22½
34	18	18½	18½	19	19	19½	19½	20	20	20½	20½	21	21	21½	21½	22

GERMAN SCALES—(Continued).

YOUTHS' AND BOYS'.

Sizes.	1 Fitt.		2 Fitt.		3 Fitt.		4 Fitt.		5 Fitt.		6 Fitt.	
	Jt.	In.	Jt.	In	Jt.	In.	Jt.	In	Jt.	In.	Jt.	In.
36	19½	20	20	20½	20½	21	21	21½	21½	22	22	22½
35	19	19½	19½	20	20	20½	20½	21	21	21½	21½	22
34	18½	19	19	19½	19½	20	20	20½	20½	21	21	21½
33	18	18½	18½	19	19	19½	19½	20	20	20½	20½	21
32	17½	18	18	18½	18½	19	19	19½	19½	20	20	20½
31	17	17½	17½	18	18	18½	18½	19	19	19½	19½	20
30	16½	17	17	17½	17½	18	18	18½	18½	19	19	19½
29	16	16½	16½	17	17	17½	17½	18	18	18½	18½	19
28	15½	16	16	16½	16½	17	17	17½	17½	18	18	18½
27	15	15½	15½	16	16	16½	16½	17	17	17½	17½	18
26	14½	15	15	15½	15½	16	16	16½	16½	17	17	17½
25	14	14½	14½	15	15	15½	15½	16	16	16½	16½	17

GERMAN SCALES—(Continued).

GIRLS'.

Sizes.	0 Fitt.		1 Fitt.		2 Fitt.		3 Fitt.		4 Fitt.		5 Fitt.		6 Fitt.	
	Jt.	In.	Jt.	In	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In
35	18½	19	19	19½	19½	20	20	20½	20½	21	21	21½	21½	22
34	18	18½	18½	19	19	19½	19½	20	20	20½	20½	21	21	21½
33	17½	18	18	18½	18½	19	19	19½	19½	20	20	20½	20½	21
32	17	17½	17½	18	18	18½	18½	19	19	19½	19½	20	20	20½
31	16½	17	17	17½	17½	18	18	18½	18½	19	19	19½	19½	20
30	16	16½	16½	17	17	17½	17½	18	18	18½	18½	19	19	19½
29	15½	16	16	16½	16½	17	17	17½	17½	18	18	18½	18½	19
28	15	15½	15½	16	16	16½	16½	17	17	17½	17½	18	18	18½
27	14½	15	15	15½	15½	16	16	16½	16½	17	17	17½	17½	18
26	14	14½	14½	15	15	15½	15½	16	16	16½	16½	17	17	17½
25	13½	14	14	14½	14½	15	15	15½	15½	16	16	16½	16½	17
24	13	13½	13½	14	14	14½	14½	15	15	15½	15½	16	16	16½

CHILDREN'S.

Sizes.	1 Fitt.		2 Fitt		3 Fitt.		4 Fitt.		5 Fitt	
	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.
23	14⅓	15	14⅔	15⅓	15	15⅔	15⅓	16	15⅔	16⅓
22	14	14⅔	14⅓	15	14⅔	15⅓	15	15⅔	15⅓	16
21	13⅔	14⅓	14	14⅔	14⅓	15	14⅔	15⅓	15	15⅔
20	13⅓	14	13⅔	14⅓	14	14⅔	14⅓	15	14⅔	15⅓
19	13	13⅔	13⅓	14	13⅔	14⅓	14	14⅔	14⅓	15
18	12⅔	13⅓	13	13⅔	13⅓	14	13⅔	14⅓	14	14⅔
17	12⅓	13	12⅔	13⅓	13	13⅔	13⅓	14	13⅔	14⅓

NORTH AMERICAN BOOT AND SHOE MEASUREMENTS.

In the United States, and North America generally, English sizes for lengths and the inch measure for girths appear to be universally used. We now give the latest standard boot and shoe measurements

UNITED STATES STANDARD BOOT AND SHOE MEASUREMENTS.

MEN'S.

Sizes		6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12
A	B	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼
	W	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛
	Ins	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝
	H	11½	11⅝	11¾	11⅞	12	12⅛	12¼	12⅜	12½	12⅝	12¾	12⅞	13
B	B	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½
	W	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜
	Ins	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	9⅞
	H	11¾	11⅞	12	12⅛	12¼	12⅜	12½	12⅝	12¾	12⅞	13	13⅛	13¼
C	B	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾
	W	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝
	Ins	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	9⅞	10	10⅛
	H	12	12⅛	12¼	12⅜	12½	12⅝	12¾	12⅞	13	13⅛	13¼	13⅜	13½
D	B	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	9⅞	10
	W	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	9⅞
	Ins	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	9⅞	10	10⅛	10¼	10⅜
	H	12¼	12⅜	12½	12⅝	12¾	12⅞	13	13⅛	13¼	13⅜	13½	13⅝	13¾

UNITED STATES MEASUREMENTS—MEN'S—(Continued).

Sizes		6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12
E	B	$8\frac{3}{4}$	$8\frac{7}{8}$	9	$9\frac{1}{8}$	$9\frac{1}{4}$	$9\frac{3}{8}$	$9\frac{1}{2}$	$9\frac{5}{8}$	$9\frac{3}{4}$	$9\frac{7}{8}$	10	$10\frac{1}{8}$	$10\frac{1}{4}$
	W	$8\frac{5}{8}$	$8\frac{3}{4}$	$8\frac{7}{8}$	9	$9\frac{1}{8}$	$9\frac{1}{4}$	$9\frac{3}{8}$	$9\frac{1}{2}$	$9\frac{5}{8}$	$9\frac{3}{4}$	$9\frac{7}{8}$	10	$10\frac{1}{8}$
	Ins	$9\frac{1}{8}$	$9\frac{1}{4}$	$9\frac{3}{8}$	$9\frac{1}{2}$	$9\frac{5}{8}$	$9\frac{3}{4}$	$9\frac{7}{8}$	10	$10\frac{1}{8}$	$10\frac{1}{4}$	$10\frac{3}{8}$	$10\frac{1}{2}$	$10\frac{5}{8}$
	H	$12\frac{1}{2}$	$12\frac{5}{8}$	$12\frac{3}{4}$	$12\frac{7}{8}$	13	$13\frac{1}{8}$	$13\frac{1}{4}$	$13\frac{3}{8}$	$13\frac{1}{2}$	$13\frac{5}{8}$	$13\frac{3}{4}$	$13\frac{7}{8}$	14
F	B	9	$9\frac{1}{8}$	$9\frac{1}{4}$	$9\frac{3}{8}$	$9\frac{1}{2}$	$9\frac{5}{8}$	$9\frac{3}{4}$	$9\frac{7}{8}$	10	$10\frac{1}{8}$	$10\frac{1}{4}$	$10\frac{3}{8}$	$10\frac{1}{2}$
	W	$8\frac{7}{8}$	9	$9\frac{1}{8}$	$9\frac{1}{4}$	$9\frac{3}{8}$	$9\frac{1}{2}$	$9\frac{5}{8}$	$9\frac{3}{4}$	$9\frac{7}{8}$	10	$10\frac{1}{8}$	$10\frac{1}{4}$	$10\frac{3}{8}$
	Ins	$9\frac{3}{8}$	$9\frac{1}{2}$	$9\frac{5}{8}$	$9\frac{3}{4}$	$9\frac{7}{8}$	10	$10\frac{1}{8}$	$10\frac{1}{4}$	$10\frac{3}{8}$	$10\frac{1}{2}$	$10\frac{5}{8}$	$10\frac{3}{4}$	$10\frac{7}{8}$
	H	$12\frac{3}{4}$	$12\frac{7}{8}$	13	$13\frac{1}{8}$	$13\frac{1}{4}$	$13\frac{3}{8}$	$13\frac{1}{2}$	$13\frac{5}{8}$	$13\frac{3}{4}$	$13\frac{7}{8}$	14	$14\frac{1}{8}$	$14\frac{1}{4}$
Width of Bottoms	A			$2\frac{20}{24}$										
	B			$2\frac{22}{24}$										
	C			3										
	D			$3\frac{2}{24}$										
	E			$3\frac{4}{24}$										
	F			$3\frac{6}{24}$										
Lengths of Lasts		$10\frac{3}{12}$	$10\frac{5}{12}$	$10\frac{7}{12}$	$10\frac{9}{12}$	$10\frac{11}{12}$	$11\frac{1}{12}$	$11\frac{3}{12}$	$11\frac{5}{12}$	$11\frac{7}{12}$	$11\frac{9}{12}$	$11\frac{11}{12}$	$12\frac{1}{12}$	$12\frac{3}{12}$

Difference between ball and instep, $\frac{3}{8}$-inch.

Widths of bottoms graded on $\frac{1}{12}$ between sizes and widths.

UNITED STATES MEASUREMENTS—(Continued).

YOUTHS'.

Sizes		1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	$5\frac{1}{2}$
A	B	$6\frac{1}{2}$	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$
	W	$6\frac{3}{8}$	$6\frac{1}{2}$	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$
	Ins	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$
	H	10	$10\frac{1}{8}$	$10\frac{1}{4}$	$10\frac{3}{8}$	$10\frac{1}{2}$	$10\frac{5}{8}$	$10\frac{3}{4}$	$10\frac{7}{8}$	11	$11\frac{1}{8}$
B	B	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$
	W	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$
	Ins	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$
	H	$10\frac{1}{4}$	$10\frac{3}{8}$	$10\frac{1}{2}$	$10\frac{5}{8}$	$10\frac{3}{4}$	$10\frac{7}{8}$	11	$11\frac{1}{8}$	$11\frac{1}{4}$	$11\frac{3}{8}$
C	B	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$
	W	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8
	Ins	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$
	H	$10\frac{1}{2}$	$10\frac{5}{8}$	$10\frac{3}{4}$	$10\frac{7}{8}$	11	$11\frac{1}{8}$	$11\frac{1}{4}$	$11\frac{3}{8}$	$11\frac{1}{2}$	$11\frac{5}{8}$
D	B	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$
	W	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$
	Ins	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{1}{2}$	$8\frac{5}{8}$
	H	$10\frac{3}{4}$	$10\frac{7}{8}$	11	$11\frac{1}{8}$	$11\frac{1}{4}$	$11\frac{3}{8}$	$11\frac{1}{2}$	$11\frac{5}{8}$	$11\frac{3}{4}$	$11\frac{7}{8}$

UNITED STATES MEASUREMENTS—YOUTHS'—(Continued).

Sizes		1	1½	2	2½	3	3½	4	4½	5	5½
E	B	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝
	W	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½
	Ins	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞
	H	11	11⅛	11¼	11⅜	11½	11⅝	11¾	11⅞	12	12⅛
F	B	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞
	W	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾
	Ins	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛
	H	11¼	11⅜	11½	11⅝	11¾	11⅞	12	12⅛	12¼	12⅜
Width of Bottoms	A					2 12/24					
	B					2 14/24					
	C					2 16/24					
	D					2 18/24					
	E					2 20/24					
	F					2 22/24					
Lengths of Lasts		8 7/12	8 9/12	8 11/12	9 1/12	9 3/12	9 5/12	9 7/12	9 9/12	9 11/12	10 1/12

Difference between ball and instep, ¼-inch.

Widths of bottoms graded on 1/12 between sizes and widths.

UNITED STATES MEASUREMENTS—(Continued).

BOYS'.

Sizes		8	8½	9	9½	10	10½	11	11½	12	12½	13	13½
A	B	$5\frac{10}{32}$	$5\frac{13}{32}$	$5\frac{16}{32}$	$5\frac{19}{32}$	$5\frac{22}{32}$	$5\frac{25}{32}$	$5\frac{7}{8}$	6	$6\frac{1}{8}$	$6\frac{1}{4}$	$6\frac{3}{8}$	$6\frac{1}{2}$
	W	$5\frac{6}{32}$	$5\frac{9}{32}$	$5\frac{12}{32}$	$5\frac{15}{32}$	$5\frac{18}{32}$	$5\frac{21}{32}$	$5\frac{3}{4}$	$5\frac{7}{8}$	6	$6\frac{1}{8}$	$6\frac{1}{4}$	$6\frac{3}{8}$
	Ins	$5\frac{18}{32}$	$5\frac{21}{32}$	$5\frac{24}{32}$	$5\frac{27}{32}$	$5\frac{30}{32}$	$6\frac{1}{32}$	$6\frac{1}{8}$	$6\frac{1}{4}$	$6\frac{3}{8}$	$6\frac{1}{2}$	$6\frac{5}{8}$	$6\frac{3}{4}$
	H	$7\frac{30}{32}$	$8\frac{1}{32}$	$8\frac{4}{32}$	$8\frac{7}{32}$	$8\frac{10}{32}$	$8\frac{13}{32}$	$8\frac{1}{2}$	$8\frac{5}{8}$	$8\frac{3}{4}$	$8\frac{7}{8}$	9	$9\frac{1}{8}$
B	B	$5\frac{18}{32}$	$5\frac{21}{32}$	$5\frac{24}{32}$	$5\frac{27}{32}$	$5\frac{30}{32}$	$6\frac{1}{32}$	$6\frac{1}{8}$	$6\frac{1}{4}$	$6\frac{3}{8}$	$6\frac{1}{2}$	$6\frac{5}{8}$	$6\frac{3}{4}$
	W	$5\frac{14}{32}$	$5\frac{17}{32}$	$5\frac{20}{32}$	$5\frac{23}{32}$	$5\frac{26}{32}$	$5\frac{29}{32}$	6	$6\frac{1}{8}$	$6\frac{1}{4}$	$6\frac{3}{8}$	$6\frac{1}{2}$	$6\frac{5}{8}$
	Ins	$5\frac{26}{32}$	$5\frac{29}{32}$	6	$6\frac{3}{32}$	$6\frac{6}{32}$	$6\frac{9}{32}$	$6\frac{3}{8}$	$6\frac{1}{2}$	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7
	H	$8\frac{6}{32}$	$8\frac{9}{32}$	$8\frac{12}{32}$	$8\frac{15}{32}$	$8\frac{18}{32}$	$8\frac{21}{32}$	$8\frac{3}{4}$	$8\frac{7}{8}$	9	$9\frac{1}{8}$	$9\frac{1}{4}$	$9\frac{3}{8}$
C	B	$5\frac{26}{32}$	$5\frac{29}{32}$	6	$6\frac{3}{32}$	$6\frac{6}{32}$	$6\frac{9}{32}$	$6\frac{3}{8}$	$6\frac{1}{2}$	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7
	W	$5\frac{22}{32}$	$5\frac{25}{32}$	$5\frac{28}{32}$	$5\frac{31}{32}$	$6\frac{2}{32}$	$6\frac{5}{32}$	$6\frac{1}{4}$	$6\frac{3}{8}$	$6\frac{1}{2}$	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$
	Ins	$6\frac{2}{32}$	$6\frac{5}{32}$	$6\frac{8}{32}$	$6\frac{11}{32}$	$6\frac{14}{32}$	$6\frac{17}{32}$	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$
	H	$8\frac{14}{32}$	$8\frac{17}{32}$	$8\frac{20}{32}$	$8\frac{23}{32}$	$8\frac{26}{32}$	$8\frac{29}{32}$	9	$9\frac{1}{8}$	$9\frac{1}{4}$	$9\frac{3}{8}$	$9\frac{1}{2}$	$9\frac{5}{8}$
D	B	$6\frac{2}{32}$	$6\frac{5}{32}$	$6\frac{8}{32}$	$6\frac{11}{32}$	$6\frac{14}{32}$	$6\frac{17}{32}$	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$
	W	$5\frac{30}{32}$	$6\frac{1}{32}$	$6\frac{4}{32}$	$6\frac{7}{32}$	$6\frac{10}{32}$	$6\frac{13}{32}$	$6\frac{1}{2}$	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$
	Ins	$6\frac{10}{32}$	$6\frac{13}{32}$	$6\frac{16}{32}$	$6\frac{19}{32}$	$6\frac{22}{32}$	$6\frac{25}{32}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$
	H	$8\frac{22}{32}$	$8\frac{25}{32}$	$8\frac{28}{32}$	$8\frac{31}{32}$	$9\frac{2}{32}$	$9\frac{5}{32}$	$9\frac{1}{4}$	$9\frac{3}{8}$	$9\frac{1}{2}$	$9\frac{5}{8}$	$9\frac{3}{4}$	$9\frac{7}{8}$

UNITED STATES MEASUREMENTS—BOYS'—(Continued).

Sizes		8	$8\frac{1}{2}$	9	$9\frac{1}{2}$	10	$10\frac{1}{2}$	11	$11\frac{1}{2}$	12	$12\frac{1}{2}$	13	$13\frac{1}{2}$
E	B	$6\frac{10}{32}$	$6\frac{13}{32}$	$6\frac{16}{32}$	$6\frac{19}{32}$	$6\frac{22}{32}$	$6\frac{25}{32}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$
	W	$6\frac{6}{32}$	$6\frac{9}{32}$	$6\frac{12}{32}$	$6\frac{15}{32}$	$6\frac{18}{32}$	$6\frac{21}{32}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$
	Ins	$6\frac{18}{32}$	$6\frac{21}{32}$	$6\frac{24}{32}$	$6\frac{27}{32}$	$6\frac{30}{32}$	$7\frac{1}{32}$	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$
	H	$8\frac{30}{32}$	$9\frac{1}{32}$	$9\frac{4}{32}$	$9\frac{7}{32}$	$9\frac{10}{32}$	$9\frac{13}{32}$	$9\frac{1}{2}$	$9\frac{5}{8}$	$9\frac{3}{4}$	$9\frac{7}{8}$	10	$10\frac{1}{8}$
F	B	$6\frac{18}{32}$	$6\frac{21}{32}$	$6\frac{24}{32}$	$6\frac{27}{32}$	$6\frac{30}{32}$	$7\frac{1}{32}$	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$
	W	$6\frac{14}{32}$	$6\frac{17}{32}$	$6\frac{20}{32}$	$6\frac{23}{32}$	$6\frac{26}{32}$	$6\frac{29}{32}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$
	Ins	$6\frac{26}{32}$	$6\frac{29}{32}$	7	$7\frac{3}{32}$	$7\frac{6}{32}$	$7\frac{9}{32}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8
	H	$9\frac{6}{32}$	$9\frac{9}{32}$	$9\frac{12}{32}$	$9\frac{15}{32}$	$9\frac{18}{32}$	$9\frac{21}{32}$	$9\frac{3}{4}$	$9\frac{7}{8}$	10	$10\frac{1}{8}$	$10\frac{1}{4}$	$10\frac{3}{8}$
Width of Bottoms	A			2				$2\frac{3}{24}$					
	B			$2\frac{3}{32}$				$2\frac{5}{24}$					
	C			$2\frac{6}{32}$				$2\frac{7}{24}$					
	D			$2\frac{9}{32}$				$2\frac{9}{24}$					
	E			$2\frac{12}{32}$				$2\frac{11}{24}$					
	F			$2\frac{15}{32}$				$2\frac{13}{24}$					
Lengths of Lasts		$6\frac{7}{12}$	$6\frac{9}{12}$	$6\frac{11}{12}$	$7\frac{1}{12}$	$7\frac{3}{12}$	$7\frac{5}{12}$	$7\frac{7}{12}$	$7\frac{9}{12}$	$7\frac{11}{12}$	$8\frac{1}{12}$	$8\frac{3}{12}$	$8\frac{5}{12}$

Difference between ball and instep, $\frac{1}{4}$-inch.

Widths of bottoms graded on $\frac{1}{12}$ between sizes and widths.

UNITED STATES MEASUREMENTS—(Continued). LADIES'

Difference between ball and instep, $\frac{3}{8}$-inch.

Sizes		$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	$5\frac{1}{2}$	6	$6\frac{1}{2}$	7
A	B	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8
	W	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$
	Ins	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$
B	B	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$
	W	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$
	Ins	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{1}{2}$	$8\frac{5}{8}$
C	B	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{1}{2}$
	W	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$
	Ins	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{1}{2}$	$8\frac{5}{8}$	$8\frac{3}{4}$	$8\frac{7}{8}$
D	B	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{1}{2}$	$8\frac{5}{8}$	$8\frac{3}{4}$
	W	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{1}{2}$	$8\frac{5}{8}$
	Ins	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{1}{2}$	$8\frac{5}{8}$	$8\frac{3}{4}$	$8\frac{7}{8}$	9	$9\frac{1}{8}$
E	B	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{1}{2}$	$8\frac{5}{8}$	$8\frac{3}{4}$	$8\frac{7}{8}$	9
	W	$7\frac{3}{4}$	$7\frac{7}{8}$	8	$8\frac{1}{8}$	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{1}{2}$	$8\frac{5}{8}$	$8\frac{3}{4}$	$8\frac{7}{8}$
	Ins	$8\frac{1}{4}$	$8\frac{3}{8}$	$8\frac{1}{2}$	$8\frac{5}{8}$	$8\frac{3}{4}$	$8\frac{7}{8}$	9	$9\frac{1}{8}$	$9\frac{1}{4}$	$9\frac{3}{8}$
Width of Bottoms	A				$2\frac{8}{24}$						
	B				$2\frac{10}{24}$						
	C				$2\frac{12}{24}$						
	D				$2\frac{14}{24}$						
	E				$2\frac{16}{24}$						
Lengths of Lasts		$9\frac{1}{12}$	$9\frac{3}{12}$	$9\frac{5}{12}$	$9\frac{7}{12}$	$9\frac{9}{12}$	$9\frac{11}{12}$	$10\frac{1}{12}$	$10\frac{3}{12}$	$10\frac{5}{12}$	$10\frac{7}{12}$

Widths of bottoms between sizes and fittings, $\frac{1}{12}$ inch.

UNITED STATES MEASUREMENTS—(Continued).

MISSES'.

Sizes		11	11½	12	12½	13	13½	1	1½	2
A	B	5¾	5⅞	6	6⅛	6¼	6⅜	6½	6⅝	6¾
	W	5⅝	5¾	5⅞	6	6⅛	6¼	6⅜	6½	6⅝
	Ins	6	6⅛	6¼	6⅜	6½	6⅝	6¾	6⅞	7
B	B	6	6⅛	6¼	6⅜	6½	6⅝	6¾	6⅞	7
	W	5⅞	6	6⅛	6¼	6⅜	6½	6⅝	6¾	6⅞
	Ins	6¼	6⅜	6½	6⅝	6¾	6⅞	7	7⅛	7¼
C	B	6¼	6⅜	6½	6⅝	6¾	6⅞	7	7⅛	7¼
	W	6⅛	6¼	6⅜	6½	6⅝	6¾	6⅞	7	7⅛
	Ins	6½	6⅝	6¾	6⅞	7	7⅛	7¼	7⅜	7½
D	B	6½	6⅝	6¾	6⅞	7	7⅛	7¼	7⅜	7½
	W	6⅜	6½	6⅝	6¾	6⅞	7	7⅛	7¼	7⅜
	Ins	6¾	6⅞	7	7⅛	7¼	7⅜	7½	7⅝	7¾

Sizes		11	11½	12	12½	13	13½	1	1½	2
E	B	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$
	W	$6\frac{5}{8}$	$6\frac{3}{4}$	$6\frac{7}{8}$	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$
	Ins	7	$7\frac{1}{8}$	$7\frac{1}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$7\frac{5}{8}$	$7\frac{3}{4}$	$7\frac{7}{8}$	8
Width of Bottoms	A					$2\frac{2}{56}$				
	B					$2\frac{7}{56}$				
	C					$2\frac{12}{56}$				
	D					$2\frac{17}{56}$				
	E					$2\frac{22}{56}$				
Lengths of Lasts		$7\frac{7}{12}$	$7\frac{9}{12}$	$7\frac{11}{12}$	$8\frac{1}{12}$	$8\frac{3}{12}$	$8\frac{5}{12}$	$8\frac{7}{12}$	$8\frac{9}{12}$	$8\frac{11}{12}$

Difference between ball and instep, $\frac{1}{4}$-inch.

Widths of bottoms graded on $\frac{4}{56}$ between sizes, and $\frac{5}{56}$ between widths.

UNITED STATES MEASUREMENTS—(Continued).

CHILDREN'S.

Sizes		6	6½	7	7½	8	8½	9	9½	10	10½
A	B	$4\frac{28}{32}$	$4\frac{31}{32}$	$5\frac{2}{32}$	$5\frac{5}{32}$	$5\frac{8}{32}$	$5\frac{11}{32}$	$5\frac{14}{32}$	$5\frac{17}{32}$	$5\frac{20}{32}$	$5\frac{23}{32}$
	W	$4\frac{26}{32}$	$4\frac{29}{32}$	5	$5\frac{3}{32}$	$5\frac{6}{32}$	$5\frac{9}{32}$	$5\frac{12}{32}$	$5\frac{15}{32}$	$5\frac{18}{32}$	$5\frac{21}{32}$
	Ins	5	$5\frac{3}{32}$	$5\frac{6}{32}$	$5\frac{9}{32}$	$5\frac{12}{32}$	$5\frac{15}{32}$	$5\frac{18}{32}$	$5\frac{21}{32}$	$5\frac{24}{32}$	$5\frac{27}{32}$
B	B	$5\frac{4}{32}$	$5\frac{7}{32}$	$5\frac{10}{32}$	$5\frac{13}{32}$	$5\frac{16}{32}$	$5\frac{19}{32}$	$5\frac{22}{32}$	$5\frac{25}{32}$	$5\frac{28}{32}$	$5\frac{31}{32}$
	W	$5\frac{2}{32}$	$5\frac{5}{32}$	$5\frac{8}{32}$	$5\frac{11}{32}$	$5\frac{14}{32}$	$5\frac{17}{32}$	$5\frac{20}{32}$	$5\frac{23}{32}$	$5\frac{26}{32}$	$5\frac{29}{32}$
	Ins	$5\frac{8}{32}$	$5\frac{11}{32}$	$5\frac{14}{32}$	$5\frac{17}{32}$	$5\frac{20}{32}$	$5\frac{23}{32}$	$5\frac{26}{32}$	$5\frac{29}{32}$	6	$6\frac{3}{32}$
C	B	$5\frac{12}{32}$	$5\frac{15}{32}$	$5\frac{18}{32}$	$5\frac{21}{32}$	$5\frac{24}{32}$	$5\frac{27}{32}$	$5\frac{30}{32}$	$6\frac{1}{32}$	$6\frac{4}{32}$	$6\frac{7}{32}$
	W	$5\frac{10}{32}$	$5\frac{13}{32}$	$5\frac{16}{32}$	$5\frac{19}{32}$	$5\frac{22}{32}$	$5\frac{25}{32}$	$5\frac{28}{32}$	$5\frac{31}{32}$	$6\frac{2}{32}$	$6\frac{5}{32}$
	Ins	$5\frac{16}{32}$	$5\frac{19}{32}$	$5\frac{22}{32}$	$5\frac{25}{32}$	$5\frac{28}{32}$	$5\frac{31}{32}$	$6\frac{2}{32}$	$6\frac{5}{32}$	$6\frac{8}{32}$	$6\frac{11}{32}$
D	B	$5\frac{20}{32}$	$5\frac{23}{32}$	$5\frac{26}{32}$	$5\frac{29}{32}$	6	$6\frac{3}{32}$	$6\frac{6}{32}$	$6\frac{9}{32}$	$6\frac{12}{32}$	$6\frac{15}{32}$
	W	$5\frac{18}{32}$	$5\frac{21}{32}$	$5\frac{24}{32}$	$5\frac{27}{32}$	$5\frac{30}{32}$	$6\frac{1}{32}$	$6\frac{4}{32}$	$6\frac{7}{32}$	$6\frac{10}{32}$	$6\frac{13}{32}$
	Ins	$5\frac{24}{32}$	$5\frac{27}{32}$	$5\frac{30}{32}$	$6\frac{1}{32}$	$6\frac{4}{32}$	$6\frac{7}{32}$	$6\frac{10}{32}$	$6\frac{13}{32}$	$6\frac{16}{32}$	$6\frac{19}{32}$

Sizes	6	$6\frac{1}{2}$	7	$7\frac{1}{2}$	8	$8\frac{1}{2}$	9	$9\frac{1}{2}$	10	$10\frac{1}{2}$
E { B W Ins	$5\frac{28}{32}$ $5\frac{26}{32}$ 6	$5\frac{31}{32}$ $5\frac{29}{32}$ $6\frac{3}{32}$	$6\frac{2}{32}$ 6 $6\frac{6}{32}$	$6\frac{5}{32}$ $6\frac{3}{32}$ $6\frac{9}{32}$	$6\frac{8}{32}$ $6\frac{6}{32}$ $6\frac{12}{32}$	$6\frac{11}{32}$ $6\frac{9}{32}$ $6\frac{15}{32}$	$6\frac{14}{32}$ $6\frac{12}{32}$ $6\frac{18}{32}$	$6\frac{17}{32}$ $6\frac{15}{32}$ $6\frac{21}{32}$	$6\frac{20}{32}$ $6\frac{18}{32}$ $6\frac{24}{32}$	$6\frac{23}{32}$ $6\frac{21}{32}$ $6\frac{27}{32}$
Width of Bottoms { A B C D E					$1\frac{28}{32}$ $1\frac{30}{32}$ 2 $2\frac{2}{32}$ $2\frac{4}{32}$					
Lengths of Lasts	$5\frac{11}{12}$	$6\frac{1}{12}$	$6\frac{3}{12}$	$6\frac{5}{12}$	$6\frac{7}{12}$	$6\frac{9}{12}$	$6\frac{11}{12}$	$7\frac{1}{12}$	$7\frac{3}{12}$	$7\frac{5}{12}$

Difference between ball and instep, $\frac{1}{8}$ inch

Widths of bottoms between sizes and fittings, $\frac{1}{16}$ inch.

SOUTH AMERICAN SIZES AND FITTINGS.

In a number of the States of South America, notably the Argentine Republic and Brazil, the French sizes and fittings are almost universally employed, and, as a large trade is done with South America, we give a scale of ladies' and gentlemen's fittings for this market.

The lasts for South America have quite a style of their own; they are generally made with a very narrow toe, the men's to carry a low heel—not more than one inch—with a very large spring in the toe—from 1½ to 1¾ inches—and rather narrow bottoms, say, 7½ centimetres wide in the forepart, and 2¾ centimetres at heel, for size 40's. The fittings, however, vary with different makers. Some take as a standard joint 22½ centimetres, instep 23½ centimetres for 3 fitting, size 40's, which is half a centimetre larger than that given in the scale.

Ladies' lasts are made in a similar manner, but to carry a rather higher heel than the men's. There seems, however, to be more variety in the fittings; these, no doubt, vary according to the class of the work, the higher class having narrow fittings, and the lower broader ones. We shall, therefore, give, in addition to the general scale, several other standard measures.

The general scale must be looked upon as an average one rather than that adopted by any manufacturer for any particular locality of South America. It would be as impossible as inexpedient to give a scale for each of the special markets.

SOUTH AMERICAN FITTINGS—(Continued).

MEN'S.

Sizes.	2 Fitt.		3 Fitt.		4 Fitt.		5 Fitt.	
	Jt.	In.	Jt.	In.	Jt.	In.	Jt.	In.
45	24	25	24½	25½	25	26	26	27
44	23½	24½	24	25	24½	25½	25½	26½
43	23	24	23½	24½	24	25	25	26
42	22½	23½	23	24	23½	24½	24½	25½
41	22	23	22½	23½	23	24	24	25
40	21½	22½	22	23	22½	23½	23½	24½
39	21	22	21½	22½	22	23	23	24
38	20½	21½	21	22	21½	22½	22½	23½
37	20	21	20½	21½	21	22	22	23

YOUTHS'.

Size	2 Fitting		3 Fitting		4 Fitting	
	Joint	Instep	Joint	Instep	Joint	Instep
36	19½	20½	20	21	20½	21½
35	19	20	19½	20½	20	21
34	18½	19½	19	20	19½	20½
33	18	19	18½	19½	19	20
32	17½	18½	18	19	18½	19½

SOUTH AMERICAN FITTINGS—(Continued).

BOYS'.

Size	2 Fitting Joint	2 Fitting Instep	3 Fitting Joint	3 Fitting Instep	4 Fitting Joint	4 Fitting Instep
31	17	18	17½	18½	18	19
30	16½	17½	17	18	17½	18½
29	16	17	16½	17½	17	18
28	15½	16½	16	17	16½	17½

LITTLE BOYS'.

Sizes	2 Fitting		3 Fitting		4 Fitting	
	Joint	Instep	Joint	Instep	Joint	Instep
27	15	16	15½	16½	16	17
26	14½	15½	15	16	15½	16½
25	14	15	14½	15½	15	16
24	13½	14½	14	15	14½	15½

LADIES'

Size	2 Fitting Joint	2 Fitting Instep	3 Fitting Joint	3 Fitting Instep	4 Fitting Joint	4 Fitting Instep
40	21	22	21½	22½	22	23
39	20½	21½	21	22	21½	22½
38	20	21	20½	21½	21	22
37	19½	20½	20	21	20½	21½
36	19	20	19½	20½	20	21
35	18½	19½	19	20	19½	20½
34	18	19	18½	19½	19	20

SOUTH AMERICAN FITTINGS—(Continued).

GIRLS'.

Sizes	2 Fitting		3 Fitting		4 Fitting	
	Joint	Instep	Joint	Instep	Joint	Instep
33	17½	18½	18	19	18½	19½
32	17	18	17½	18½	18	19
31	16½	17½	17	18	17½	18½
30	16	17	16½	17½	17	18
29	15½	16½	16	17	16½	17½

GIRLS'.

Sizes.	2 Fitt.		3 Fitt.		4 Fitt.	
	Jt.	In.	Jt.	In.	Jt.	In.
28	15	16	15½	16½	16	17
27	14½	15½	15	16	15½	16½
26	14	15	14½	15½	15	16
25	13½	14½	14	15	14½	15½
24	13	14	13½	14½	14	15

CHILDREN'S.

Sizes.	2 Fitt.		3 Fitt.		4 Fitt.	
	Jt.	In.	Jt.	In.	Jt.	In.
23	13	14	13½	14½	14	15
22	12½	13½	13	14	13½	14½
21	12	13	12½	13½	13	14
20	11½	12½	12	13	12½	13½
19	11	12	11½	12½	12	13

In ranging the bottom wid'hs. one-quarter of a centimetre is given from size to size at the joint. and one-sixth of a centimere for the heel. in the men's.

In the ladies' one-sixth of a centimetre is given from size to size at the joint. and one-ninth at the heel.

OTHER SOUTH AMERICAN STANDARDS

36. Ladies'. 3 fitting.
Joint 20½, instep 23 centimetres.
Width of joint 6¾ centimetres.
Width of heel 5 centimetres.

30. Girls'.
Joint 17, instep 20 centimetres.
Width of joint 6 centimetres.
Width of heel 4⅛ centimetres.
½ a centimetre between sizes at joint and instep.
¼ a centimetra between sizes across joint.
⅙ a centimetre between sizes across heel.

36. Ladies'. 3 fitting.
Joint 21, instep 23 centimetres.
Width of joint 6½ centimetres.
Width of heel 5 centimetres.

24. Children's.
Joint 15½, instep 17 centimetres.
Width of joint 5 centimetres.
Width of heel 3½ centimetres.

THE END